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CFC REMOVAL DEMONSTRATION PROJECT: A FINAL REPORT

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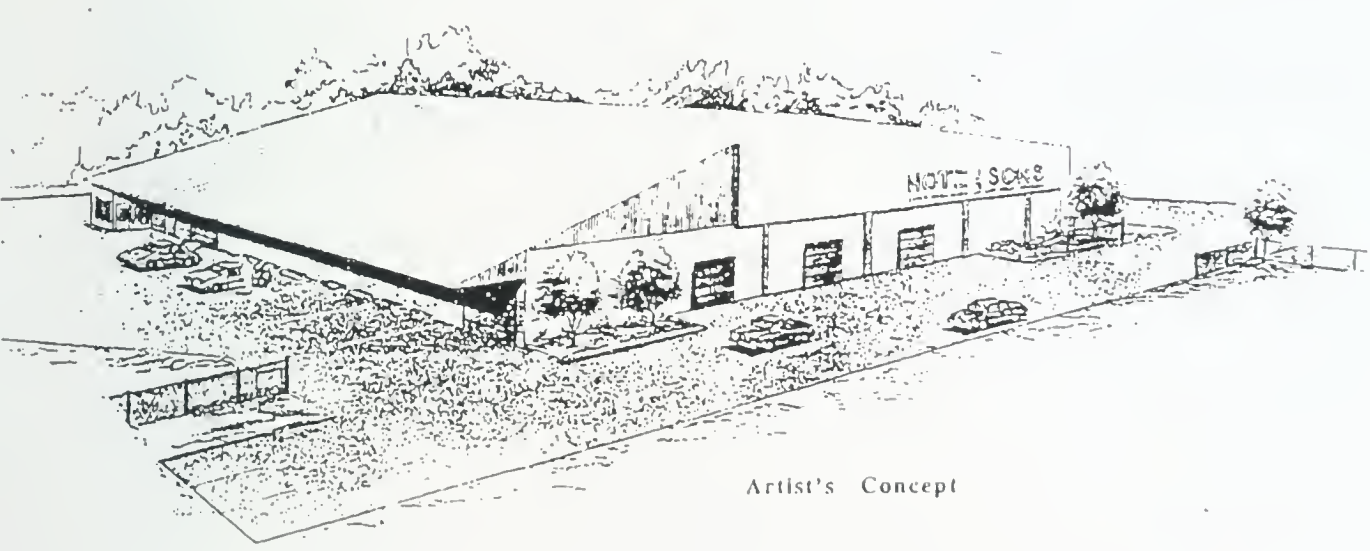
Hotz Environmental Services Inc.

CFC Removal Demonstration Project: A Final Report

prepared for: Ontario Ministry of Environment and Energy
Waste Reduction Branch
Program Implementation Section

The Regional Municipality of Hamilton-Wentworth
Environmental Services Department



Artist's Concept

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EXECUTIVE SUMMARY

A new regulation to prevent the release of fluorocarbon refrigerants into the atmosphere has been in effect in Ontario since March 29, 1994. As of December 1, 1995, the disposal of household refrigeration equipment will also be regulated under Regulation 189/94 (MOEE 1994). Prior to disposal, domestic appliances will have to be tagged and labelled free of ozone-depleting substances, by a certified technician. Currently five million home refrigeration appliances are in use in Ontario. This report has been assembled by Hotz Environmental Services Inc. for the Ministry of the Environment and Energy, to provide municipalities with the information required to develop programs that comply with this new regulation.

A five month pilot study was conducted by Hotz Environmental Services Inc. for The Regional Municipality of Hamilton-Wentworth. The study focused on the planning, implementation and operation of a CFC-bearing white goods recovery/evacuation program. Format, equipment, personnel and cost were some of the considerations that were targeted. Three existing white good collection methods were utilized: daily curbside collection, semi-annual bulk collection and transfer station drop-offs. Evacuation was executed by certified technicians in the home, at the transfer stations and in Hotz's own yard. The two types of equipment used for evacuation were the Halozone Blue Bottle Sysytem and the Thermaflo OZ 4000 Saver Light recovery unit. Since six municipalities of varying sizes were evaluated, this study provides information for a range of potential programs.

The favourable results obtained from this project clearly indicate that a CFC evacuation/recovery program can be successfully implemented for Ontario regions of these sizes. The data obtained from this study can be compared to other relevant CFC recovery programs but is not intended to represent or predict results for future projects. The results of the study demonstrate: the most practical method to evacuate CFC-bearing white goods discarded in The Regional Municipality of Hamilton-Wentworth was using central collection depots, either waste transfer stations or the Hotz facility. The Thermaflo recovery unit was determined to be cheaper to operate and a more effective means of recovery than the Halozone Blue Bottle system.

Data collected and statistics calculated from this study are presented throughout this report for interpretation. Recommendations with respect to program development and operation, should be made based on the individual needs of each region. It is recommended that further studies of this type be done to collect more representative and conclusive data.

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GLOSSARY OF TERMS AND ABBREVIATIONS

CFCs - Chlorofluorocarbons
HCFCs - Hydrochlorofluorocarbons
HFCs - Hydrofluorocarbons
Hotz - Hotz Environmental Services Inc.
MOEE - Ministry of Environment and Energy
The Region - The Regional Municipality of Hamilton-Wentworth
Thermaflo - Thermaflo OZ4000 Saver Light Recovery Unit
Halozone - Halozone Recycling Inc.
Blue Bottle Method - Halozone Blue Bottle Recovery Method

(Terms for Table Interpretation):

Kenora - Kenora Street Waste Transfer Station
Ottawa - Upper Ottawa Street Waste Transfer Station
Dundas - Dundas Waste Transfer Station
Home - In Home Service
Hotz Facility - 239 Lottridge Street, Hamilton, Ontario
Recovery Tank - Refrigerant Recovery Tank, Thermaflo Method (recovery capacity 50 lbs.)
Small Bottle - Small Size Halozone Blue Bottle (recovery capacity 1 lb.)
Medium Bottle - Medium Size Halozone Blue Bottle (recovery capacity 5 lbs.)
Large Bottle - Large Size Halozone Blue Bottle (recovery capacity 10 lbs.)
Multple Bottles - Combination of two or more Recovery Cylinders (Halozone and/or Thermaflo)
Potential No. - Number of White Goods scheduled for Curbside Collection
Site - Site where Evacuation took place
Method - Method of Technology used for Evacuation
Total No. - Actual Number of White Goods Collected or Evacuated
L. Fridges - Number of Large Refrigerators
S. Fridges - Number of Small, Bar-type Refrigerators
A/Cs - Number of Air Conditioners
Dehums - Number of Dehumidifiers
Freezs - Number of Freezers (Chest-type)
Other - Number of Other Types of CFC-bearing White Goods
R-12 - Number of Appliances Containing CFC-12 Refrigerant
R-22 - Number of Appliances Containing CFC-22 Refrigerant
R-Other - Number of Appliances Containing Other Types of Refrigerant
Empty - Number of Appliances with No Refrigerant
Weight (lbs.) - Weight of Recovered CFCs
Techs - Number of Technicians Used
Hours - Number of Service Hours Worked

1.0 INTRODUCTION

1.1 Background Information

Chlorofluorocarbons (CFCs) are man-made chemicals which are very stable. They are generally non-flammable and non-toxic and have been used as refrigerants, as blowing agents for foam manufacturing, as propellents for aerosols and as cleaning solvents. When they are released into the atmosphere, CFC molecules are broken down by ultraviolet radiation. The by-products of this chemical reaction can contribute to the destruction of ozone molecules in the earth's ozone layer. A milestone in global commitment was attained in 1987 when an agreement known as the Montreal Protocol was developed. The agreement calls for eliminating the use of certain CFCs and HCFCs (Hydrochlorofluorocarbons) by January 1, 1996. To date, the Montreal Protocol has been signed by more than 100 nations. Canada was a major player in the development of this treaty and continues to support the rapid reductions in the use of CFCs.

Ontario Regulation 189/94 of the Environmental Protection Act was filed on March 29, 1994. It states that, "No person shall discharge or cause or permit the discharge of a refrigerant into the natural environment." This regulation will become applicable to the disposal of domestic refrigeration equipment on December 1, 1995. In order to assist in the development of programs to comply with this new regulation, the Ministry of Environment and Energy (MOEE), with the aid of municipalities and industrial partners, selected three communities to conduct pilot studies. One large, one small and one Northern Ontario community were chosen to provide data regarding a collection and evacuation program for CFC-bearing, household white goods. Regulation 189/94, has been included in Appendix A for reference (MOEE 1994).

The Regional Municipality of Hamilton-Wentworth (The Region), was selected to represent a sample large community. The Region consists of The City of Hamilton, The City of Stoney Creek, The Town of Dundas, The Town of Ancaster, The Town of Flamborough and The Township of Glanbrook. The Region covers a total area of 113,843 hectares. The population of The Region is 451,684 with a total of 155,585 households.

The pilot study was conducted by Hotz Environmental Services Inc. (Hotz). Hotz is a Hamilton-based company specializing in hazardous waste management. Hotz currently operates the permanent household hazardous waste collection depot for The Region. This facility was utilized to carry out most of the field work as well as the administrative functions of the study.

The pilot study provided a forum for the research and collection of data regarding the cost and efficiency of implementing a CFC recovery program for residential refrigeration equipment. The diversity of the six municipalities within The Region provided an interesting cross section of community size and program methodology. There are currently three methods of collection available for residents requesting disposal of white goods in The Region: curbside collection, semi-annual bulk collection and waste transfer station drop-offs. It was decided not to change or interupt

these programs during the study, but rather to utilize them for the collection of CFC-bearing white goods. Three modes of service (or evacuation) by Hotz technicians were implemented: evacuation in the home, evacuation at the three regional waste transfer stations and evacuation at the Hotz facility. For comparison purposes, two different evacuation technologies were incorporated into the research: the Halozone Blue Bottle system and the Thermaflo OZ 4000 Saver Light recovery unit.

This pilot study provides additional data to previously completed studies such as the Cassandra Report (The Kingston Area CFC Committee 1993) and the Rural Ontario CFC Removal Report produced by Bellmisch Enterprises Inc. (1994). The following text presents the planning, collection, evacuation and reporting practices conducted over a five month period from January 30, 1995 to June 30, 1995. The white good collection data, evacuation data, conclusions and recommendations of the pilot study are contained herein.

1.2 Objectives of Study

The CFC Removal Demonstration Project has attempted to accomplish four main objectives:

1) To compare and report which of the evacuation and recovery systems is the most efficient from a technical and environmental standpoint (e.g. minimizes operation costs and maximizes capture).

2) To establish a database which will form the basis for the design of a region-wide program utilizing two different evacuation systems and three different collection modes.

3) To assess the applicability of the demonstration project for implementation in other Ontario regions and municipalities.

4) To obtain CFC collection and recovery data that can be compared to other, relevant programs.

1.3 Scope of Study

The overall project studied The Regional Municipality of Hamilton-Wentworth which is comprised of six area municipalities. Three modes of service were implemented and reviewed as well as two types of evacuation/recovery methods.

Stage 1 - Access: CFC-bearing white goods were collected for evacuation at one of the three service locations (home service, transfer station or the Hotz facility via curbside collection).

Stage 2 - Evacuation: Evacuation took place at each of the above mentioned locations. Two different technologies were utilized in the evacuation/recovery process (Halozone Blue Bottle System and the Thermaflo Recovery Unit).

Stage 3- Data Collection: An integral aspect of the project was the collection and recording of the data obtained from all aspects of project operation. The formulation of a database and the daily entry of statistics provided the basis for monthly progress reports and this final report.

2.0 METHODOLOGY

Several aspects of this study required consideration before a detailed work plan could be implemented. This section highlights the primary areas of planning involved for determining CFC-bearing white good collection and evacuation procedures.

2.1 Preliminary Administrative Work

Several meetings were held involving The Region, the MOEE and Hotz Environmental Services Inc., prior to the implementation of this study. Additional meetings were held with the waste management co-ordinators from each area municipality to discuss and obtain their input on the design of a work plan. Subsequently, notification was given to the existing white goods collection contractors to request their co-operation. Since this was only a pilot study, it was agreed that the program would be implemented and run without promotion. The intent was to leave the existing structure of the programs undisturbed and minimize confusion among householders.

Upon approval from the MOEE for commencement of the pilot study, many arrangements were carried out simultaneously. The recovery equipment comparison process began and several aspects of data collection were considered. The development of a work order, for use by our technicians to record key information on site , was a crucial aspect of the project. An adhesive label (tag) was also created, to be affixed to each evacuated appliance, certifying that they are "CFC-free." Samples of the work order and tag are found in Appendix B. Three technicians attended the Ozone Depletion Prevention training course and obtained their certifications in accordance with Regulation 189/94, Section 21 (MOEE 1994). Parameters for personal responsibilities were set and work schedules were established for preparation, operation and conclusion of the project.

2.2 Modes of Service

In order to determine the most practical and economical method of evacuation of domestic refrigerants, three different modes of service were tested and compared.

Home Service

The home service has been regarded as the most efficient service mode from an environmental standpoint, because handling and transportation of the appliance occurs only after evacuation. This procedure reduces the chance of damaging the appliance and releasing any remaining CFCs to the atmosphere. However, it was also suspected that this service mode would also be the most expensive to operate. We proposed that three home service days would be sufficient for gathering the desired amount of data. The City of Stoney Creek was chosen as the sample municipality for the home services. Trained technicians entered homes to evacuate and tag appliances. It was then the responsibility of the resident to move the appliance to their curb for regular collection.

Transfer Station

Statistics have shown that residents take a significant number of white goods directly to one of the three regional waste transfer stations. For the purpose of this study, the transfer stations will be referred to as Kenora Street, Upper Ottawa Street and Dundas. The need for evacuation services at these collection locations was recognized. Trained technicians were on call to visit each site, to evacuate and to tag any accumulated, CFC-bearing white goods. These appliances were to be set aside and handled by the regional operators of these sites. A minimum number of 20 appliances were required to accumulate at the site before Hotz technicians were dispatched.

Hotz Facility

The third mode of service which involves curbside pick-up, tests the concept of returning all CFC-bearing, household white goods to a central facility for evacuation. The Hotz facility, located at 239 Lottridge Street, was designated as the collection depot for the duration of this study. Appliances were collected by Hotz through the daily curbside program in The City of Hamilton and the semi-annual bulk collections in The Town of Flamborough, and transported directly to Hotz. With this mode of service, Hotz was responsible for a closed loop operation: collection, evacuation, handling and scrap metal recycling.

2.3 Six Area Municipalities

As mentioned, The Region is divided into six area municipalities. Each municipality is self-governed and has a unique program in place for the collection and disposal of household white goods. These programs have been designed to meet the specific needs of each municipality and were addressed separately when planning this study. Map 2.1 was obtained from the Region's Planning and Development Department, to identify regional development patterns and area boundaries (Region 1994).

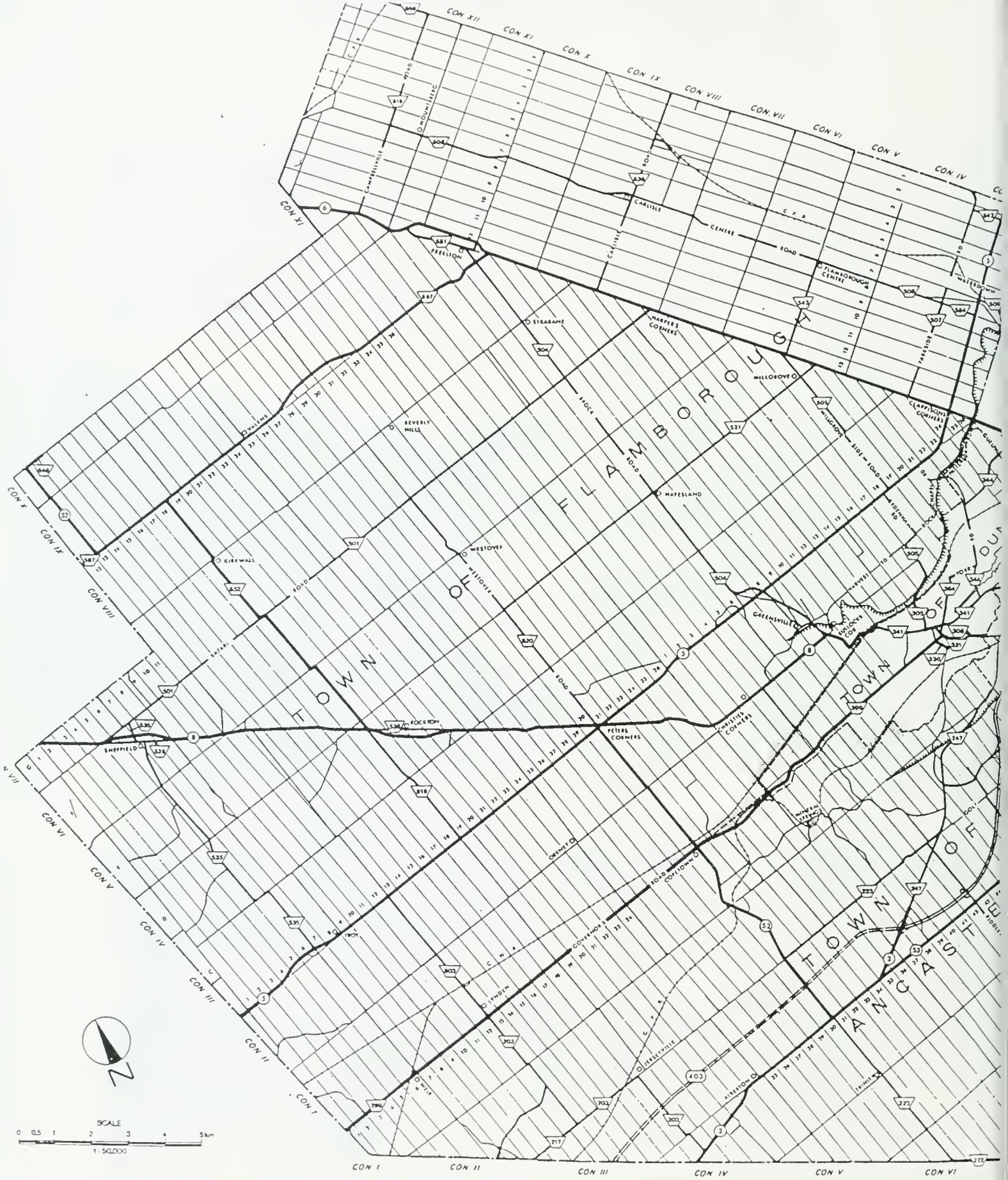
The City of Hamilton operates a daily curbside collection program for household white goods. Residents call to inform The City of Hamilton that an appliance is being discarded and The City of Hamilton schedules a pick-up. The collection contractor is responsible for transporting the white goods to a designated recycling facility. Hotz was employed for the collection, evacuation and recycling of CFC-bearing white goods for the duration of the study, specifically January 30, 1995 to June 30, 1995.

The City of Stoney Creek operates a weekly curbside collection program. Residents call The City of Stoney Creek and arrange to have the appliance picked up at their curb on a specific day. The contractor collects the goods and transports them directly to a designated recycling facility. For the duration of this study, the contractor agreed to divert any CFC-bearing white goods to the Kenora Street transfer station where they were evacuated by Hotz at a later date. The City of Stoney Creek also volunteered to be the sample municipality for the home services. Three Fridays were chosen

MAP 2.1:

The Regional Municipality
of Hamilton-Wentworth

Planning and Development Department
Hamilton-Wentworth Region


CON XII
CON XI
CON X
CON IX
CON VIII
CON VII
CON VI
CON V
CON IV
CON XI
CON X
CON IX
CON VIII
CON VII
CON VI
CON V
CON IV
CON III
CON II
CON I
CON I
CON II
CON III
CON IV
CON V
CON VI
TOWNSHIP OF ESQUESING
TOWNSHIP OF NASSAGAWEYA
TOWNSHIP OF HALTON HILLS
TOWN OF MILTON
CAMPBELLVILLE
ROAD
CARLISLE
CENTRE ROAD
FLAMBOROUGH CENTRE
WATERDOWN
FREELTON
STEARNE
HARRIS CORNERS
MILLGROVE
CLAPPISONS CORNERS
BEVERLY HILLS
WALKERS
SIDE ROAD
HAYESLAND
WESTOVER
EDEN MILLS
GREENSVILLE
LIMEHOUSE
ESQUESING
ROAD
SHEPPARD
ACTON
PETERS CORNERS
CHRISTIES CORNERS
MINAKE
CREEK
COOPERSTOWN
COVERDALE
LINDEN
JERSEYVILLE
ALBERTON
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(March 10, April 7 and May 12) to service a maximum of 25 homes. Residents were asked to participate in the study over the phone when they called to request a pick-up. They were given a designated date and time at which to expect Hotz technicians at their homes. The resident had to place the evacuated, tagged appliance at curbside for the following Monday's collection. The contractor was instructed to continue diverting any untagged CFC-bearing white goods to the Kenora station.

The Town of Dundas operates semi-annual bulk collection days for household white goods. Residents are informed which days are designated for collection. The Town of Dundas collects any goods at curbside and transports them directly to a designated location. For the duration of this study, all CFC-bearing white goods were delivered to their public works yard, where they were evacuated by Hotz technicians prior to recycling.

The Town of Ancaster operates a similar semi-annual bulk collection. During the study period, the collection contractor was requested to divert any CFC-bearing white goods to a collection yard to be evacuated by Hotz technicians at a later date.

The Town of Flamborough also utilizes semi-annual bulk collection days to recycle household appliances. Residents are informed by The Town of Flamborough which days are designated for collection. Hotz was contracted during the study period to collect CFC-bearing white goods and transport them to the Hotz facility for evacuation. Hotz was also responsible for appliance handling and scrap metal recycling.

The Township of Glanbrook operates random curbside collections as required. Residents call The Township of Glanbrook to request disposal. When enough white goods have accumulated, a truck is sent out to pick them up. The contractor transports the white goods directly to a designated recycling facility. During the course of this study, the contractor was asked to divert any CFC-bearing white goods to the Hotz facility for evacuation and subsequent scrap metal recycling.

In addition to these collection services, residents of The Region can personally deliver white goods to any of the three transfer stations. For the duration of the study, CFC-bearing white goods were also being accepted at the Hotz facility.

2.4 Recovery Equipment

In order to accurately assess and compare refrigerant recovery data, it was determined that a minimum of two types of recovery equipment needed to be incorporated into the study. Five types of recovery units were suggested and demonstrated by various sales agents . The recovery equipment comparison chart found in Appendix C, lists the specifications for the five units considered. The two types that were chosen and purchased were the Halozone Blue Bottle system and the Thermaflo OZ 4000 Saver Light recovery unit. Sales brochures for each of these units are included in Appendix D.

The Blue Bottle system is a new technology which utilizes zeolite filter media to chemically absorb most types of refrigerant in liquid or vapour phase. The patented Blue Bottles are operated in line with a Robinair 15400 vacuum pump, which pulls refrigerant from the appliance and passes it through a zeolite chamber where the refrigerant is absorbed. The advantages inherent to the Halozone method are that recovery is effective regardless of temperature and that it offers maximum recovery rates for both liquids and vapour. Once a Blue Bottle is full, it can be returned to Halozone's recycling plant in Mississauga, Ontario, where the refrigerant is extracted from the zeolite media and reclaimed to virgin quality for reuse.

The Thermaflo recovery unit is one of many types of compressor-driven units on the market, which pulls refrigerant from a system and stores it as a liquid in pressurized cylinders for the purpose of reuse. These units are standard tools for heating, refrigeration and air conditioning industries. What makes the Thermaflo unique is its oil-less compressor which eliminates the problem of oil contamination and disposal. The unit also possesses a sub-cooling feature which can prevent high pressure build-ups during evacuation, allowing for faster and more effective recovery at most temperatures. When the cylinders are full, they can be sent to a refrigerant reclaimer like Anachemia Solvents Ltd. in Mississauga, Ontario, where the refrigerant is reclaimed to virgin quality for reuse. The advantage to this method is that non-contaminated refrigerant is valuable and can offset recovery costs.

A detailed list of the recovery equipment and accessories purchased by Hotz for this study has been included in Appendix E.

2.5 Site Preparation

Once it was decided that the Hotz facility was to be used as the primary collection and recovery depot for this study, planning was done to determine what preparation was required. Several concerns were addressed including; spacial contraints, safety factors and operational procedures. Site prenotification, required under Ontario Regulation 347 for the establishment of a domestic refrigerant collection site, was submitted to the MOEE. Slight modifications to the Hotz facility were required. An insulated room was constructed for operation and equipment storage and specific areas of the yard were designated for white good storage and scrap metal recycling bins.

It was initially determined that no site modifications were required for home services or transfer station services prior to the commencement of the study. After consulting with the regional operators of the waste transfer stations, they requested that Hotz construct holding bunkers at each site using cement blocks. These bunkers segregated the CFC-bearing white goods and acted as protection until evacuation was complete.

A complete list of the site modifications made and the costs incurred can be found in Appendix F.

3.0 PROJECT RESULTS

3.1 Work Program

The following work program highlights the accomplishments of the three stages of program operation for the CFC Removal Demonstration Project: access, evacuation and data collection. The data has been tabulated and summarized in a series of tables at the end of this section. Please refer to Appendix G for a detailed summary of the standard operating procedures for the collection and evacuation of CFC-bearing white goods used for this study.

Stage 1 - Access

This first stage focuses on the accessibility of CFC-bearing white goods, throughout the course of this study. As discussed earlier, each of the six area municipalities operate a unique collection program.

Initially, there were three home service days scheduled in The City of Stoney Creek. For comparison, four additional days were completed in The City of Hamilton, bringing the total to 25 homes. None of the 25 CFC-bearing white goods serviced in the home were located in the kitchen. The majority had been moved outside to the porch or driveway when the new appliance was delivered. Only six of the 25 appliances remained inside the home: two in the basement and four in the garage.

The three transfer stations were serviced 22 days during the five month study. This total includes one day of servicing CFC-bearing white goods collected from The Town of Dundas' bulk collection. Evacuation of these goods took place in the public works yard adjacent to the Dundas transfer station. CFC-bearing white goods were stored in cement block bunkers at each of the transfer stations to isolate them and protect them from damage. Hotz was informed by the site operators when each of the three sites reached its capacity of approximately 20 appliances. Hotz had easy access to each of the three sites for the duration of the study.

For this study period, Hotz operated the daily curbside collection of CFC-bearing white goods in The City of Hamilton and the semi-annual bulk collection in The Town of Flamborough. The City of Hamilton had a total of 108 collection days. Only 653 of the scheduled 1291 appliances were actually collected. Three days were designated to operate the spring collection of CFC-bearing white goods in The Town of Flamborough. Hotz collected 145 CFC-bearing white goods from curbside over this period.

Stage 2 - Evacuation

CFC refrigerant was evacuated from household white goods in each of the three modes of service:

home service, transfer station and at the Hotz facility. Both methods of recovery, the Blue Bottle method and the Thermaflo recovery unit were employed in each of these settings.

The first type of evacuation took place in the home. Over a seven day period, 25 homes were serviced in The City of Stoney Creek and The City of Hamilton. The appliances were evacuated and tagged by trained technicians. A total of 100 ounces or 2.835 kilograms of CFCs was recovered in the home service mode.

Hotz technicians were also sent to evacuate CFC-bearing white goods at the three regional transfer stations. A total of 22 service days took place in the transfer station mode. Over this period, 439 CFC-bearing white goods were evacuated and tagged. A total of 1219.2 ounces or 34.563 kilograms of CFCs was recovered in the transfer station mode.

The majority of evacuation took place at the Hotz facility using appliances discarded from The City of Hamilton and The Town of Flamborough. Within 71 days of service, 811 CFC-bearing white goods were evacuated. Each appliance was tagged and forwarded for scrap metal recycling. This service mode recovered 1769.6 ounces or 50.166 kilograms of CFCs.

Stage 3 - Data Collection

Data collected during this study period was recorded on CFC Project work orders. These work orders were carefully designed to be an effective method of collecting data for both collection and recovery services. Information from the work orders was transferred directly to personal computer by means of a database program created using Microsoft Access. Monthly data was tabulated to produce progress reports submitted to the MOEE and The Region's Environmental Services Department. By the end of the five month study period, 111 work orders were generated from the collection of CFC-bearing white goods and transportation to the Hotz facility. In addition, 100 work orders were generated from evacuation services.

3.2 Data Tables

The following tables are presented to summarize the information collected during this study. The use of statistical methods are only provided to allow for easier interpretation of the data. These statistics should in no way be regarded as standards or generalizations for other studies or services of this nature.

Table 3.1 is a data summary table for the entire project period which breaks down the results by area municipality. Key statistics have been calculated using data from all six areas.

Table 3.2 is a recovery mode data summary which provides evacuation data for each mode of collection and each recovery technology. In order to estimate the metric tonnes of white goods that

were serviced; an average weight per white good was predetermined. This calculation was done using scale tickets from the scrap metal recycling vehicles leaving the Hotz facility. The net weight of all goods serviced at the Hotz facility was divided by the number to give an average weight of 242 lbs. or 0.11 metric tonnes per white good.

Table 3.3 is a recovery mode cost summary table which determines the actual cost per unit for collecting and evacuating white goods for each of the three modes of collection and each of the recovery technologies. These costs are based on a rate of pay of $22.50 per technician per hour. The figures are based strictly on operating costs and do not include capital costs, administration costs and transportation costs (except in the Hotz facility mode), associated with this study. The cost estimates for the transfer station do not include appliance handling charges which were the responsibility of the site operators. All applicable taxes are not included in the calculations.

Table 3.4 is a summary table of all data collected from work orders generated from the collection and transportation of white goods to the Hotz facility.

Table 3.5 is a summary table of all data collected from work orders generated from the evacuation of white goods in all modes of collection.

Table 3.6 is a summary table of all recovery data collected from the home services.

Table 3.7 is a summary table of all recovery data collected at the Kenora Street transfer station.

Table 3.8 is a summary table of all recovery data collected at the Upper Ottawa Street transfer station.

Table 3.9 is a summary table of all recovery data collected at the Dundas transfer station.

Table 3.10 is a summary table of recovery data collected from all three modes of collection using the Halozone Blue Bottle refrigerant recovery method.

Table 3.11 is a summary table of recovery data collected from all three modes of collection using the Thermaflo refrigerant recovery method.

TABLE 3.1: PROJECT DATA SUMMARY
CFC Removal Demonstration Project Final Report

STATISTICS to date:	Hamilto	Dundas	St.Creek	Ancaster	Glanb.	Flamb.	*TOTAL*
Number of Transport Days:	**108**					**3**	**111**
Number of Recovery Days:	**74**	**8**	**8**			**10**	**100**
In-Home Service	4		3				7
Hotz Facility	61					10	71
Transfer Station	9	8	5				22
Scheduled Number of Goods For Collection:	**1291**					**145**	**1436**
Actual Number of Goods Collected:	**653**					**145**	**798**
Refrigerators	444					96	540
Small Fridges	12					2	14
Air Conditioners	36					14	50
Dehumidifiers	32					9	41
Freezers	128					24	152
Other	1						1
Number of Goods Evacuated:	**857**	**153**	**120**			**145**	**1275**
Refrigerators	575	108	82			96	861
Small Fridges	30	7	2			2	41
Air Conditioners	55	9	10			14	88
Dehumidifiers	34	2				9	45
Freezers	162	27	26			24	239
Other	1						1
Remaining Goods On Site Awaiting Evacuation:	**0**					**0**	**0**
Number Of Evacuated Goods With:							
R-12 Type Refrigerant	558	106	79			106	849
R-22 Type Refrigerant	44	10	8			11	73
Other	8	5	1				14
Empty or Damaged	247	32	32			28	339
Number of Evacuated Goods Per Method Of Recovery:	**857**	**153**	**120**			**145**	**1275**
Blue Bottle Absorption	370	45	32			10	457
Therma-Flo Recovery	487	108	88			135	818
Refrigerant Recovered (LBS):	**126.1**	**23.95**	**16.5**			**26.5**	**193.05**
R-12 Type	86.35	18.95	11.25			22	138.55
R-22 Type	39.75	5	5.25			4.5	54.5
Transport Service Hours:	400					52	**452**
Recovery Service Hours:	289	40.5	32			47	**408.5**

Average Evacuation Time Per Good (Min.)	**19.2**
Average Weight of Recovered Refrigerant Per Good (OZ.)	**2.42**
Average Weight of Refrigerant Per Good, Excluding Empty Or Damaged Goods (OZ.)	**3.64**
Percentage of Scheduled Goods for Collection That Were Actually Collected (%)	**55.6**
Gross Weight of Evacuated White Goods (KG)	**140250**
Percentage of Recovered Refrigerant Per Weight of Goods Evacuated (%)	**0.063**

TABLE 3.2: RECOVERY MODE DATA SUMMARY
CFC Removal Demonstration Project Final Report

Recovery Technology:	Mode of Service:	No.of Goods:	Ounces of CFC:	Tonnes of Goods:	Service Hours:	Average Service Time per Good(Min.):	Average CFC Recovered per Good (OZ):
TOTAL	In-home	25	100	2.75	20.5	49.2	4
	Transfer Station	439	1219.2	48.29	114	15.58	2.78
	Hotz Facility	811	1769.6	89.21	274	20.27	2.18
HALOZONE BLUE BOTTLE	In-home	17	52	1.87	12	42.35	3.06
	Transfer Station	102	219.2	11.22	24.5	14.41	2.15
	Hotz Facility	338	561.6	37.18	119	21.12	1.66
THERMAFLO RECOVERY UNIT	In-home	8	48	0.88	8.5	63.75	6
	Transfer Station	337	1000	37.07	89.5	15.93	2.97
	Hotz Facility	473	1208	52.03	155	19.66	2.55

TABLE 3.3: RECOVERY MODE COST SUMMARY
CFC Removal Demonstration Project Final Report

Recovery Technology	Mode of Service	Average Cost per White Good (CA$)	Average Cost per Ounce of CFC (CA$)	Average Cost per Tonne of Goods (CA$)
TOTAL	In-home	79.00	19.75	718.18
	Transfer Station	22.01	7.92	200.05
	Hotz Facility	22.77	10.43	206.96
	Hotz Facility with Transport	84.07	38.53	764.30
HALOZONE BLUE BOTTLE	In-home	71.62	23.41	651.07
	Transfer Station	23.02	10.71	209.27
	Hotz Facility	24.83	14.94	225.69
	Hotz Facility with Transport	86.61	52.13	787.35
THERMAFLO RECOVERY	In-home	94.69	15.78	860.80
	Transfer Station	21.70	7.31	197.26
	Hotz Facility	21.29	8.34	193.58
	Hotz Facility with Transport	82.26	32.21	747.83

(Costs do not include applicable taxes)

TABLE 3.4: COLLECTION AND TRANSPORTATION SUMMARY
CFC Removal Demonstration Project Final Report

Date:	Area:	Site:	Potential No.:	Total No.:	L.Fridges:	S.Fridges:	A/Cs:	Dehums:	Freezers:	Other:	Hours:	Techs:
30-Jan-95	HAMILTON	HOTZ	3	2	2	0	0	0	0	0	2.5	2
31-Jan-95	HAMILTON	HOTZ	10	7	5	0	0	0	2	0	3.5	2
01-Feb-95	HAMILTON	HOTZ	9	3	3	0	0	0	0	0	4	2
02-Feb-95	HAMILTON	HOTZ	3	1	1	0	0	0	0	0	2	2
03-Feb-95	HAMILTON	HOTZ	10	4	4	0	0	0	0	0	6	2
06-Feb-95	HAMILTON	HOTZ	6	5	3	0	0	0	2	0	3.5	2
07-Feb-95	HAMILTON	HOTZ	3	1	1	0	0	0	0	0	2.5	2
08-Feb-95	HAMILTON	HOTZ	9	2	2	0	0	0	0	0	4.5	2
09-Feb-95	HAMILTON	HOTZ	4	3	2	0	1	0	0	0	2	2
10-Feb-95	HAMILTON	HOTZ	3	3	2	0	0	1	0	0	2	2
13-Feb-95	HAMILTON	HOTZ	11	6	5	0	0	0	1	0	5	2
14-Feb-95	HAMILTON	HOTZ	7	2	1	0	0	0	1	0	5.5	2
15-Feb-95	HAMILTON	HOTZ	12	8	5	0	1	1	1	0	5.5	2
16-Feb-95	HAMILTON	HOTZ	7	3	2	0	0	0	1	0	4	2
17-Feb-95	HAMILTON	HOTZ	9	5	5	0	0	0	0	0	5	2
20-Feb-95	HAMILTON	HOTZ	13	12	11	0	0	0	1	0	6	2
21-Feb-95	HAMILTON	HOTZ	17	6	6	0	0	0	0	0	6	2
22-Feb-95	HAMILTON	HOTZ	5	4	3	0	0	0	1	0	3.5	2
23-Feb-95	HAMILTON	HOTZ	10	6	4	0	1	0	1	0	6	2
24-Feb-95	HAMILTON	HOTZ	11	6	4	0	1	0	1	0	6	2
27-Feb-95	HAMILTON	HOTZ	7	6	4	0	0	0	2	0	2.5	2
28-Feb-95	HAMILTON	HOTZ	9	2	1	0	1	0	0	0	2	2
01-Mar-95	HAMILTON	HOTZ	6	4	2	0	0	0	2	0	3.5	2
02-Mar-95	HAMILTON	HOTZ	6	4	2	0	0	2	0	0	3.5	2
03-Mar-95	HAMILTON	HOTZ	5	3	2	0	0	0	1	0	3.5	2
06-Mar-95	HAMILTON	HOTZ	8	7	7	0	0	0	0	0	3	2
07-Mar-95	HAMILTON	HOTZ	11	9	6	0	0	0	3	0	4	2
08-Mar-95	HAMILTON	HOTZ	6	4	3	0	0	0	1	0	2	2
09-Mar-95	HAMILTON	HOTZ	5	3	3	0	0	0	0	0	2	2
10-Mar-95	HAMILTON	HOTZ	7	6	4	0	0	0	2	0	3	2
13-Mar-95	HAMILTON	HOTZ	5	4	2	1	0	1	0	0	2.5	2
14-Mar-95	HAMILTON	HOTZ	6	3	2	0	0	0	1	0	2	2
15-Mar-95	HAMILTON	HOTZ	9	4	2	0	0	0	2	0	3	2
16-Mar-95	HAMILTON	HOTZ	20	7	4	0	1	0	2	0	5	2
17-Mar-95	HAMILTON	HOTZ	10	9	3	0	1	1	4	0	4.5	2
20-Mar-95	HAMILTON	HOTZ	10	4	3	0	0	0	1	0	2.5	2
21-Mar-95	HAMILTON	HOTZ	13	6	5	0	0	0	1	0	3	2
22-Mar-95	HAMILTON	HOTZ	8	1	1	0	0	0	0	0	3	2
23-Mar-95	HAMILTON	HOTZ	9	3	3	0	0	0	0	0	2.5	2
24-Mar-95	HAMILTON	HOTZ	10	8	6	0	1	0	1	0	3	2
27-Mar-95	HAMILTON	HOTZ	12	9	4	1	0	1	3	0	5	2
28-Mar-95	HAMILTON	HOTZ	11	5	4	0	1	0	0	0	3.5	2
29-Mar-95	HAMILTON	HOTZ	10	7	4	0	0	0	3	0	2	2

TABLE 3.4: COLLECTION AND TRANSPORTATION SUMMARY
CFC Removal Demonstration Project Final Report

Date:	Area:	Site:	Potential No.:	Total No.:	L.Fridges:	S.Fridges:	A/Cs:	Dehums:	Freezers:	Other:	Hours:	Techs:
30-Mar-95	HAMILTON	HOTZ	16	11	9	0	0	0	2	0	3.5	2
31-Mar-95	HAMILTON	HOTZ	18	12	8	0	0	0	4	0	3	2
03-Apr-95	HAMILTON	HOTZ	12	10	6	0	0	0	4	0	4	2
04-Apr-95	HAMILTON	HOTZ	10	4	3	0	0	0	1	0	2.5	2
05-Apr-95	HAMILTON	HOTZ	14	9	6	0	0	0	3	0	4	2
06-Apr-95	HAMILTON	HOTZ	11	6	4	0	0	0	2	0	3.5	2
07-Apr-95	HAMILTON	HOTZ	17	7	5	0	0	0	2	0	5	2
10-Apr-95	HAMILTON	HOTZ	9	5	3	0	0	0	2	0	3	2
11-Apr-95	HAMILTON	HOTZ	6	5	5	0	0	0	0	0	2	2
12-Apr-95	HAMILTON	HOTZ	6	3	0	0	1	2	0	0	3	2
13-Apr-95	HAMILTON	HOTZ	11	7	4	0	0	1	2	0	3.5	2
17-Apr-95	HAMILTON	HOTZ	4	4	4	0	0	0	0	0	2	2
18-Apr-95	HAMILTON	HOTZ	19	10	9	0	0	0	1	0	6.5	2
19-Apr-95	HAMILTON	HOTZ	9	1	1	0	0	0	0	0	3.5	2
20-Apr-95	HAMILTON	HOTZ	4	4	3	0	0	0	1	0	2	2
21-Apr-95	HAMILTON	HOTZ	10	4	3	0	0	0	1	0	3	2
24-Apr-95	HAMILTON	HOTZ	10	8	6	1	1	0	0	0	2.5	2
25-Apr-95	HAMILTON	HOTZ	13	8	5	1	1	0	1	0	3.5	2
26-Apr-95	HAMILTON	HOTZ	20	12	8	0	0	0	4	0	3	2
27-Apr-95	HAMILTON	HOTZ	11	9	7	0	0	0	2	0	3.5	2
28-Apr-95	HAMILTON	HOTZ	10	10	6	0	0	0	4	0	6	2
01-May-95	HAMILTON	HOTZ	16	14	7	0	3	2	2	0	5.5	2
02-May-95	HAMILTON	HOTZ	14	9	8	0	0	0	1	0	4	2
03-May-95	HAMILTON	HOTZ	17	5	4	1	0	0	0	0	4	2
04-May-95	HAMILTON	HOTZ	13	6	4	0	0	0	2	0	3.5	2
05-May-95	HAMILTON	HOTZ	18	5	4	0	0	1	0	0	4	2
08-May-95	HAMILTON	HOTZ	27	16	12	0	2	0	2	0	5.5	2
09-May-95	HAMILTON	HOTZ	16	5	3	0	0	1	1	0	3.5	2
10-May-95	HAMILTON	HOTZ	15	1	0	0	0	1	0	0	3	2
11-May-95	HAMILTON	HOTZ	13	5	5	0	0	0	0	0	3	2
12-May-95	HAMILTON	HOTZ	18	13	9	0	0	3	1	0	5	2
15-May-95	HAMILTON	HOTZ	10	5	4	0	0	0	0	1	3	2
16-May-95	HAMILTON	HOTZ	23	8	6	0	1	0	1	0	5.5	2
17-May-95	HAMILTON	HOTZ	13	3	1	1	0	1	0	0	2.5	2
18-May-95	HAMILTON	HOTZ	14	8	6	0	1	1	0	0	3	2
19-May-95	HAMILTON	HOTZ	19	4	3	0	0	0	1	0	4.5	2
23-May-95	HAMILTON	HOTZ	14	9	7	0	0	0	2	0	3.5	2
24-May-95	HAMILTON	HOTZ	13	3	2	0	1	0	0	0	3	2
25-May-95	HAMILTON	HOTZ	14	1	0	0	0	0	1	0	2.5	2
26-May-95	HAMILTON	HOTZ	23	11	5	0	1	2	3	0	5	2
27-May-95	FLAMBORO	HOTZ	71	71	52	0	1	1	17	0	22.5	2
29-May-95	HAMILTON	HOTZ	13	6	4	0	0	0	2	0	3	2
30-May-95	HAMILTON	HOTZ	15	8	3	2	1	0	2	0	4	2

TABLE 3.4: COLLECTION AND TRANSPORTATION SUMMARY
CFC Removal Demonstration Project Final Report

Date:	Area:	Site:	Potential No.:	Total No.:	L.Fridges:	S.Fridges:	A/Cs:	Dehums:	Freezers:	Other:	Hours:	Techs:
31-May-95	HAMILTON	HOTZ	18	6	5	0	0	0	1	0	4	2
01-Jun-95	HAMILTON	HOTZ	4	1	0	0	1	0	0	0	1.5	2
02-Jun-95	HAMILTON	HOTZ	9	7	4	0	1	0	2	0	3	2
03-Jun-95	FLAMBORO	HOTZ	24	24	17	0	0	1	6	0	12.5	2
05-Jun-95	HAMILTON	HOTZ	22	8	5	0	1	0	2	0	5	2
06-Jun-95	HAMILTON	HOTZ	10	4	2	0	2	0	0	0	3	2
07-Jun-95	HAMILTON	HOTZ	10	8	2	0	1	3	2	0	3	2
08-Jun-95	HAMILTON	HOTZ	9	4	3	0	0	0	1	0	3	2
09-Jun-95	HAMILTON	HOTZ	15	6	5	0	0	0	1	0	3.5	2
10-Jun-95	FLAMBORO	HOTZ	50	50	27	2	13	7	1	0	17	2
12-Jun-95	HAMILTON	HOTZ	18	11	7	1	1	2	0	0	4.5	2
13-Jun-95	HAMILTON	HOTZ	24	14	9	0	1	2	2	0	6	2
14-Jun-95	HAMILTON	HOTZ	14	8	5	0	1	0	2	0	4	2
15-Jun-95	HAMILTON	HOTZ	12	9	6	0	1	0	2	0	5	2
16-Jun-95	HAMILTON	HOTZ	15	9	6	2	1	0	0	0	4.5	2
19-Jun-95	HAMILTON	HOTZ	16	9	6	0	1	0	2	0	4	2
20-Jun-95	HAMILTON	HOTZ	16	4	2	0	0	1	1	0	4	2
21-Jun-95	HAMILTON	HOTZ	12	4	2	0	0	1	1	0	3	2
22-Jun-95	HAMILTON	HOTZ	17	7	5	0	0	0	2	0	4	2
23-Jun-95	HAMILTON	HOTZ	18	5	2	0	1	0	2	0	4	2
26-Jun-95	HAMILTON	HOTZ	13	8	5	0	1	0	2	0	4.5	2
27-Jun-95	HAMILTON	HOTZ	22	4	1	1	0	0	2	0	3.5	2
28-Jun-95	HAMILTON	HOTZ	19	2	1	0	0	0	1	0	4	2
29-Jun-95	HAMILTON	HOTZ	15	6	4	0	0	0	2	0	5	2
30-Jun-95	HAMILTON	HOTZ	20	8	7	0	0	1	0	0	5.5	2
TOTAL:	111		1436	798	540	14	50	41	152	1	452	

TABLE 3.5: RECOVERY/EVACUATION SUMMARY
CFC Removal Demonstration Project Final Report

Date:	Area:	Site:	Total No.:	Method:	L.Fridges	S.Fridges	A/Cs:	Dehums:	Freezs:	Other:	R-12:	R-22:	R-Other:	Empty:	Weight(lbs):	Hours:	Techs:
22-Dec-94	HAMILTON	HOTZ	5	Recovery Tank	5	0	0	0	0	0	0	0	0	5	0	2.5	3
03-Jan-95	HAMILTON	HOTZ	5	Recovery Tank	5	0	0	0	0	0	0	0	0	5	0	3	3
23-Jan-95	HAMILTON	HOTZ	2	Small Bottle	1	0	1	0	0	0	2	0	0	0	0.25	3	3
01-Feb-95	HAMILTON	HOTZ	2	Recovery Tank	2	0	0	0	0	0	0	0	0	2	0	3.5	3
06-Feb-95	HAMILTON	HOTZ	7	Small Bottle	6	0	0	0	1	0	3	0	0	4	0.5	2	3
08-Feb-95	HAMILTON	HOTZ	7	Small Bottle	7	0	0	0	0	0	5	0	0	2	0.75	2.5	2
09-Feb-95	HAMILTON	HOTZ	6	Small Bottle	5	0	0	0	1	0	5	0	0	1	0.25	4	2
01-Mar-95	HAMILTON	HOTZ	9	Large Bottle	7	0	0	0	2	0	6	0	0	3	0.75	3.5	2
02-Mar-95	HAMILTON	HOTZ	9	Large Bottle	9	0	0	0	0	0	8	0	0	1	0.5	4	2
03-Mar-95	HAMILTON	HOTZ	13	Large Bottle	12	0	0	0	1	0	6	0	0	7	0.5	4.5	2
06-Mar-95	HAMILTON	HOTZ	13	Large Bottle	13	0	0	0	0	0	10	0	0	3	0.5	4	2
07-Mar-95	DUNDAS	DUNDAS	12	Large Bottle	11	0	0	0	1	0	9	0	0	3	0.2	4	2
07-Mar-95	HAMILTON	HOTZ	8	Large Bottle	7	0	0	0	1	0	6	0	0	2	0.3	2.5	2
09-Mar-95	HAMILTON	HOTZ	22	Large Bottle	17	0	0	0	5	0	14	0	0	8	0.5	5.5	2
10-Mar-95	STONEY	HOME	5	Small Bottle	3	0	0	0	2	0	4	0	0	1	0.5	4	2
13-Mar-95	HAMILTON	HOTZ	27	Large Bottle	17	2	0	0	8	0	15	0	0	12	2	5	2
14-Mar-95	HAMILTON	HOTZ	16	Large Bottle	11	1	0	0	4	0	13	0	0	3	2.9	5	2
17-Mar-95	HAMILTON	HOTZ	10	Large Bottle	6	0	0	0	4	0	7	0	0	3	0.1	3	2
20-Mar-95	HAMILTON	HOTZ	12	Large Bottle	8	0	0	0	4	0	9	0	0	3	1.05	5	2
21-Mar-95	HAMILTON	HOTZ	10	Large Bottle	6	0	0	0	4	0	4	0	0	6	0.25	3.5	1
22-Mar-95	HAMILTON	OTTAWA	27	Recovery Tank	16	1	2	0	8	0	13	0	1	13	1.75	6.5	2
23-Mar-95	STONEY	KENORA	26	Recovery Tank	16	0	0	0	10	0	16	0	0	10	0.75	6.5	2
24-Mar-95	HAMILTON	HOTZ	11	Recovery Tank	9	1	0	0	1	0	8	0	0	3	0.25	3.5	2
27-Mar-95	HAMILTON	HOTZ	6	Recovery Tank	3	0	0	0	3	0	1	0	0	5	0	3	2
28-Mar-95	HAMILTON	HOTZ	5	Recovery Tank	5	0	0	0	0	0	1	0	0	4	0	3.5	2
29-Mar-95	HAMILTON	HOTZ	8	Recovery Tank	4	1	0	0	3	0	4	0	0	4	0.25	5.5	1
30-Mar-95	HAMILTON	HOTZ	4	Recovery Tank	0	0	4	0	0	0	0	4	0	0	4.25	4	2
31-Mar-95	HAMILTON	OTTAWA	13	Recovery Tank	9	2	0	0	2	0	10	0	0	3	0.5	3.5	1
03-Apr-95	HAMILTON	HOTZ	6	Recovery Tank	6	0	0	0	0	0	2	0	1	3	0	4	2
05-Apr-95	HAMILTON	HOTZ	2	Medium Bottle	0	0	2	0	0	0	0	2	0	0	0.25	2	2
06-Apr-95	DUNDAS	DUNDAS	26	Large Bottle	18	3	0	0	5	0	13	0	4	9	0.5	4.5	2
06-Apr-95	HAMILTON	HOTZ	11	Large Bottle	9	0	0	0	2	0	8	0	0	3	1.25	3	2
07-Apr-95	STONEY	HOME	1	Large Bottle	1	0	0	0	0	0	1	0	0	0	0.25	1	2
07-Apr-95	STONEY	KENORA	22	Multple Bottles	12	0	6	0	4	0	12	5	0	5	4.5	5	2
10-Apr-95	HAMILTON	HOTZ	15	Small Bottle	10	1	0	0	4	0	8	0	0	7	0.5	4	2
11-Apr-95	HAMILTON	HOTZ	13	Small Bottle	11	0	0	0	2	0	9	0	0	4	0.5	5.5	2
12-Apr-95	HAMILTON	HOTZ	6	Small Bottle	3	0	0	0	3	0	5	0	0	1	0.5	3.5	2
13-Apr-95	HAMILTON	HOTZ	1	Small Bottle	0	0	1	0	0	0	0	1	0	0	0.5	4	1
17-Apr-95	HAMILTON	HOTZ	14	Small Bottle	10	0	3	0	1	0	6	1	0	7	1.5	5.5	2
18-Apr-95	HAMILTON	HOTZ	5	Small Bottle	5	0	0	0	0	0	3	0	2	0	0.5	1.5	2
19-Apr-95	HAMILTON	OTTAWA	31	Multple Bottles	17	1	1	2	10	0	20	1	1	9	6.75	8	1
20-Apr-95	HAMILTON	HOTZ	21	Large Bottle	19	0	0	0	2	0	11	0	0	10	0.75	6.5	2
21-Apr-95	HAMILTON	HOTZ	6	Recovery Tank	6	0	0	0	0	0	6	0	0	0	0.25	3	2

TABLE 3.5: RECOVERY/EVACUATION SUMMARY
CFC Removal Demonstration Project Final Report

Date:	Area:	Site:	Total No.:	Method:	L.Fridges	S.Fridges	A/Cs:	Dehums:	Freezs:	Other:	R-12:	R-22:	R-Other:	Empty:	Weight(lbs):	Hours:	Techs:
24-Apr-95	HAMILTON	HOTZ	5	Recovery Tank	5	0	0	0	0	0	1	0	0	4	0	1.5	2
25-Apr-95	HAMILTON	HOTZ	2	Recovery Tank	1	0	0	0	1	0	0	0	0	2	0	2	2
26-Apr-95	HAMILTON	HOTZ	12	Recovery Tank	8	2	0	0	2	0	11	0	0	1	1.25	3	2
27-Apr-95	DUNDAS	DUNDAS	14	Recovery Tank	9	0	0	0	5	0	9	0	0	5	0.25	3.5	2
03-May-95	STONEY	KENORA	20	Multple Bottles	16	0	0	0	4	0	13	0	1	6	1.5	3.5	2
05-May-95	HAMILTON	HOTZ	17	Recovery Tank	12	0	0	0	5	0	9	0	1	7	2	3.5	2
08-May-95	HAMILTON	OTTAWA	30	Recovery Tank	19	0	1	1	9	0	23	1	0	6	5	8	1
09-May-95	HAMILTON	HOTZ	16	Multple Bottles	11	0	4	0	1	0	8	3	0	5	2.75	3.5	2
10-May-95	HAMILTON	HOTZ	8	Recovery Tank	4	0	0	4	0	0	6	0	0	2	1.25	4.5	2
11-May-95	HAMILTON	HOTZ	22	Multple Bottles	13	0	0	7	2	0	18	0	0	4	2.25	4.5	2
12-May-95	STONEY	HOME	2	Recovery Tank	1	0	0	0	1	0	2	0	0	0	0.5	2.5	2
15-May-95	DUNDAS	DUNDAS	24	Recovery Tank	18	1	0	2	3	0	20	0	1	3	4	6.5	2
16-May-95	HAMILTON	HOTZ	7	Recovery Tank	6	0	0	1	0	0	5	0	0	2	0.75	1.5	2
17-May-95	HAMILTON	HOTZ	20	Recovery Tank	11	3	0	1	5	0	14	0	0	6	1.5	5	2
18-May-95	HAMILTON	HOTZ	15	Multple Bottles	12	0	2	0	1	0	9	3	0	3	5	5.5	2
19-May-95	HAMILTON	HOTZ	13	Multple Bottles	5	0	3	2	3	0	11	1	0	1	3.25	2.5	2
23-May-95	HAMILTON	HOTZ	19	Multple Bottles	13	1	0	0	5	0	13	0	0	6	3.25	4	2
29-May-95	FLAMBORO	HOTZ	16	Multple Bottles	13	1	0	0	2	0	10	0	0	6	1	6	2
30-May-95	DUNDAS	DUNDAS	18	Multple Bottles	14	2	0	0	2	0	15	1	0	2	3.25	4	2
30-May-95	HAMILTON	OTTAWA	15	Multple Bottles	7	2	3	0	3	0	10	2	0	3	3.25	4	2
31-May-95	FLAMBORO	HOTZ	3	Recovery Tank	3	0	0	0	0	0	3	0	0	0	1.5	1	2
31-May-95	HAMILTON	HOME	2	Small Bottle	2	0	0	0	0	0	2	0	0	0	0.5	2	2
01-Jun-95	FLAMBORO	HOTZ	22	Recovery Tank	14	0	0	1	7	0	18	0	0	4	5.25	6	2
02-Jun-95	FLAMBORO	HOTZ	11	Multple Bottles	8	1	2	0	0	0	8	1	0	2	2.5	4.5	2
05-Jun-95	DUNDAS	DUNDAS	22	Multple Bottles	17	0	1	0	4	0	16	1	0	5	3.25	7	2
06-Jun-95	HAMILTON	HOTZ	30	Recovery Tank	22	1	0	2	5	0	25	0	0	5	5.75	8	2
07-Jun-95	HAMILTON	OTTAWA	3	Multple Bottles	0	0	3	0	0	0	0	2	0	1	2.25	2	2
07-Jun-95	STONEY	KENORA	24	Multple Bottles	15	2	4	0	3	0	15	3	0	6	6	5.5	2
08-Jun-95	FLAMBORO	HOTZ	11	Recovery Tank	8	0	0	1	2	0	8	0	0	3	1	2.5	2
08-Jun-95	HAMILTON	OTTAWA	12	Multple Bottles	3	0	9	0	0	0	3	9	0	0	7.25	5.5	2
09-Jun-95	FLAMBORO	HOTZ	3	Recovery Tank	3	0	0	0	0	0	2	0	0	1	0.5	2	2
09-Jun-95	HAMILTON	HOTZ	3	Small Bottle	0	0	0	3	0	0	2	0	0	1	0.5	2	2
12-Jun-95	HAMILTON	HOTZ	14	Multple Bottles	13	0	0	0	1	0	9	0	0	5	1	3	2
13-Jun-95	HAMILTON	HOTZ	4	Recovery Tank	3	0	0	0	1	0	1	0	0	3	0.25	2	2
14-Jun-95	HAMILTON	HOTZ	6	Recovery Tank	4	1	0	0	1	0	6	0	0	0	0.75	4	2
15-Jun-95	HAMILTON	HOME	9	Large Bottle	6	0	0	0	3	0	6	0	0	3	2	5	2
15-Jun-95	HAMILTON	HOTZ	9	Large Bottle	7	0	0	0	2	0	9	0	0	0	2.5	3	2
16-Jun-95	HAMILTON	HOTZ	11	Large Bottle,	8	1	0	0	2	0	6	0	1	4	2.75	3	2
19-Jun-95	HAMILTON	HOTZ	10	Large Bottle	7	1	0	0	2	0	9	0	0	1	1.75	3.5	2
20-Jun-95	HAMILTON	HOTZ	11	Recovery Tank	1	0	9	0	0	1	0	8	0	3	9	3.5	2
21-Jun-95	HAMILTON	OTTAWA	26	Multple Bottles	15	1	3	1	6	0	21	3	0	2	8	8	2
22-Jun-95	HAMILTON	HOTZ	12	Recovery Tank	8	0	0	0	4	0	10	0	0	2	1.75	3.5	2
23-Jun-95	DUNDAS	DUNDAS	21	Multple Bottles	15	1	2	0	3	0	17	2	0	2	9	7	2

TABLE 3.5: RECOVERY/EVACUATION SUMMARY
CFC Removal Demonstration Project Final Report

Date:	Area:	Site:	Total No.:	Method:	L.Fridges	S.Fridges	A/Cs:	Dehums:	Freezs:	Other:	R-12:	R-22:	R-Other:	Empty:	Weight(lbs):	Hours:	Techs:
26-Jun-95	HAMILTON	HOTZ	14	Recovery Tank	4	0	0	8	2	0	12	0	0	2	2	3	2
27-Jun-95	HAMILTON	HOTZ	19	Recovery Tank	11	2	0	1	5	0	15	0	0	4	2.5	4	2
28-Jun-95	HAMILTON	HOME	2	Recovery Tank	1	0	0	0	1	0	2	0	0	0	0.5	3	2
28-Jun-95	STONEY	KENORA	20	Recovery Tank	18	0	0	0	2	0	16	0	0	4	2.5	4	2
29-Jun-95	HAMILTON	HOME	4	Recovery Tank	2	0	0	0	2	0	4	0	0	0	2	3	2
29-Jun-95	HAMILTON	HOTZ	15	Recovery Tank	11	1	0	0	3	0	11	0	0	4	0.5	3	2
30-Jun-95	DUNDAS	DUNDAS	16	Multple Bottles	6	0	6	0	4	0	7	6	0	3	3.5	4	2
30-Jun-95	HAMILTON	OTTAWA	17	Multple Bottles	10	3	2	0	2	0	11	1	1	4	2.25	3.5	2
04-Jul-95	HAMILTON	HOTZ	30	Recovery Tank	22	1	0	1	6	0	25	0	0	5	5.5	7.5	2
05-Jul-95	FLAMBORO	HOTZ	16	Recovery Tank	16	0	0	0	0	0	13	0	0	3	3	5.5	2
05-Jul-95	HAMILTON	HOTZ	5	Multple Bottles	2	0	2	0	1	0	3	2	0	0	2	2	2
06-Jul-95	FLAMBORO	HOTZ	21	Recovery Tank	21	0	0	0	0	0	18	0	0	3	3	7.5	2
07-Jul-95	FLAMBORO	HOTZ	21	Recovery Tank	10	0	0	0	11	0	18	0	0	3	3	7.5	2
10-Jul-95	FLAMBORO	HOTZ	21	Multple Bottles	0	0	12	7	2	0	8	10	0	3	5.75	7.5	2
TOTAL:	100		1275		861	41	88	45	239	1	849	73	14	339	193.05	408.5	

TABLE 3.6: HOME SERVICES RECOVERY SUMMARY
CFC Removal Demonstration Project Final Report

Date:	Area:	Site:	Method:	Total No.:	L.Fridge:	S.Fridge:	A/Cs:	Dehums:	Freez:	Other:	R-12:	R-22:	R-Other:	Empty:	Weight(lbs):	Techs:	Hours:
10-Mar-95	STONEY	HOME	Small Bottle	5	3	0	0	0	2	0	4	0	0	1	0.5	2	4
07-Apr-95	STONEY	HOME	Large Bottle	1	1	0	0	0	0	0	1	0	0	0	0.25	2	1
12-May-95	STONEY	HOME	Recovery Tank	2	1	0	0	0	1	0	2	0	0	0	0.5	2	2.5
31-May-95	HAMILTON	HOME	Small Bottle	2	2	0	0	0	0	0	2	0	0	0	0.5	2	2
15-Jun-95	HAMILTON	HOME	Large Bottle	9	6	0	0	0	3	0	6	0	0	3	2	2	5
28-Jun-95	HAMILTON	HOME	Recovery Tank	2	1	0	0	0	1	0	2	0	0	0	0.5	2	3
29-Jun-95	HAMILTON	HOME	Recovery Tank	4	2	0	0	0	2	0	4	0	0	0	2	2	3
TOTAL:	7			25	16	0	0	0	9	0	21	0	0	4	6.25		20.5

TABLE 3.7: KENORA STREET TRANSFER STATION RECOVERY SUMMARY
CFC Removal Demonstration Project Final Report

Date:	Area:	Site:	Method:	Total No.:	L.Fridge:	S.Fridge:	A/Cs:	Dehums:	Freez:	Other:	R-12:	R-22:	R-Other:	Empty:	Weight(lbs):	Techs:	Hours:
23-Mar-95	STONEY	KENORA	Recovery Tank	26	16	0	0	0	10	0	16	0	0	10	0.75	2	6.5
07-Apr-95	STONEY	KENORA	Multple Bottles	22	12	0	6	0	4	0	12	5	0	5	4.5	2	5
03-May-95	STONEY	KENORA	Multple Bottles	20	16	0	0	0	4	0	13	0	1	6	1.5	2	3.5
07-Jun-95	STONEY	KENORA	Multple Bottles	24	15	2	4	0	3	0	15	3	0	6	6	2	5.5
28-Jun-95	STONEY	KENORA	Recovery Tank	20	18	0	0	0	2	0	16	0	0	4	2.5	2	4
TOTAL:	5			112	77	2	10	0	23	0	72	8	1	31	15.25		24.5

TABLE 3.8: UPPER OTTAWA STREET TRANSFER STATION RECOVERY SUMMARY

CFC Removal Demonstration Project Final Report

Date:	Area:	Site:	Method:	Total No.:	L.Fridge:	S.Fridge:	A/Cs:	Dehum:	Freez:	Other:	R-12:	R-22:	R-Other:	Empty:	Weight(lbs):	Techs:	Hours:
22-Mar-95	HAMILTON	OTTAWA	Recovery Tank	27	16	1	2	0	8	0	13	0	1	13	1.75	2	6.5
31-Mar-95	HAMILTON	OTTAWA	Recovery Tank	13	9	2	0	0	2	0	10	0	0	3	0.5	1	3.5
19-Apr-95	HAMILTON	OTTAWA	Multple Bottles	31	17	1	1	2	10	0	20	1	1	9	6.75	1	8
08-May-95	HAMILTON	OTTAWA	Recovery Tank	30	19	0	1	1	9	0	23	1	0	6	5	1	8
30-May-95	HAMILTON	OTTAWA	Multple Bottles	15	7	2	3	0	3	0	10	2	0	3	3.25	2	4
07-Jun-95	HAMILTON	OTTAWA	Multple Bottles	3	0	0	3	0	0	0	0	2	0	1	2.25	2	2
08-Jun-95	HAMILTON	OTTAWA	Multple Bottles	12	3	0	9	0	0	0	3	9	0	0	7.25	2	5.5
21-Jun-95	HAMILTON	OTTAWA	Multple Bottles	26	15	1	3	1	6	0	21	3	0	2	8	2	8
30-Jun-95	HAMILTON	OTTAWA	Multple Bottles	17	10	3	2	0	2	0	11	1	1	4	2.25	2	3.5
TOTAL:	9			174	96	10	24	4	40	0	111	19	3	41	37		49

TABLE 3.9: DUNDAS TRANSFER STATION RECOVERY SUMMARY
CFC Removal Demonstration Project Final Report

Date:	Area:	Site:	Method:	Total No.:	L.Fridge:	S.Fridge:	A/Cs:	Dehum:	Freez:	Other:	R-12:	R-22:	R-Other:	Empty:	Weight(lbs):	Techs:	Hours:
07-Mar-95	DUNDAS	DUNDAS	Large Bottle	12	11	0	0	0	1	0	9	0	0	3	0.2	2	4
06-Apr-95	DUNDAS	DUNDAS	Large Bottle	26	18	3	0	0	5	0	13	0	4	9	0.5	2	4.5
27-Apr-95	DUNDAS	DUNDAS	Recovery Tank	14	9	0	0	0	5	0	9	0	0	5	0.25	2	3.5
15-May-95	DUNDAS	DUNDAS	Recovery Tank	24	18	1	0	2	3	0	20	0	1	3	4	2	6.5
30-May-95	DUNDAS	DUNDAS	Multple Bottles	18	14	2	0	0	2	0	15	1	0	2	3.25	2	4
05-Jun-95	DUNDAS	DUNDAS	Multple Bottles	22	17	0	1	0	4	0	16	1	0	5	3.25	2	7
23-Jun-95	DUNDAS	DUNDAS	Multple Bottles	21	15	1	2	0	3	0	17	2	0	2	9	2	7
30-Jun-95	DUNDAS	DUNDAS	Multple Bottles	16	6	0	6	0	4	0	7	6	0	3	3.5	2	4
TOTAL:	8			153	108	7	9	2	27	0	106	10	5	32	23.95		40.5

TABLE 3.10: HALOZONE BLUE BOTTLE RECOVERY SUMMARY

CFC Removal Demonstration Project Final Report

Date:	Area.	Site:	Method:	Total No.:	L.Fridge:	S.Fridge:	A/Cs:	Dehum:	Freez:	Other:	R-12:	R-22:	R-Other:	Empty:	Weight(lbs):	Techs:	Hours:
23-Jan-95	HAMILTON	HOTZ	Small Bottle	2	1	0	1	0	0	0	2	0	0	0	0.25	3	3
06-Feb-95	HAMILTON	HOTZ	Small Bottle	7	6	0	0	0	1	0	3	0	0	4	0.5	3	2
08-Feb-95	HAMILTON	HOTZ	Small Bottle	7	7	0	0	0	0	0	5	0	0	2	0.75	2	2.5
09-Feb-95	HAMILTON	HOTZ	Small Bottle	6	5	0	0	0	1	0	5	0	0	1	0.25	2	4
01-Mar-95	HAMILTON	HOTZ	Large Bottle	9	7	0	0	0	2	0	6	0	0	3	0.75	2	3.5
02-Mar-95	HAMILTON	HOTZ	Large Bottle	9	9	0	0	0	0	0	8	0	0	1	0.5	2	4
03-Mar-95	HAMILTON	HOTZ	Large Bottle	13	12	0	0	0	1	0	6	0	0	7	0.5	2	4.5
07-Mar-95	DUNDAS	DUNDAS	Large Bottle	12	11	0	0	0	1	0	9	0	0	3	0.2	2	4
06-Mar-95	HAMILTON	HOTZ	Large Bottle	13	13	0	0	0	0	0	10	0	0	3	0.5	2	4
07-Mar-95	HAMILTON	HOTZ	Large Bottle	8	7	0	0	0	1	0	6	0	0	2	0.3	2	2.5
09-Mar-95	HAMILTON	HOTZ	Large Bottle	22	17	0	0	0	5	0	14	0	0	8	0.5	2	5.5
10-Mar-95	STONEY	HOME	Small Bottle	5	3	0	0	0	2	0	4	0	0	1	0.5	2	4
13-Mar-95	HAMILTON	HOTZ	Large Bottle	27	17	2	0	0	8	0	15	0	0	12	2	2	5
14-Mar-95	HAMILTON	HOTZ	Large Bottle	16	11	1	0	0	4	0	13	0	0	3	2.9	2	5
20-Mar-95	HAMILTON	HOTZ	Large Bottle	12	8	0	0	0	4	0	9	0	0	3	1.05	2	5
17-Mar-95	HAMILTON	HOTZ	Large Bottle	10	6	0	0	0	4	0	7	0	0	3	0.1	2	3
21-Mar-95	HAMILTON	HOTZ	Large Bottle	10	6	0	0	0	4	0	4	0	0	6	0.25	1	3.5
06-Apr-95	DUNDAS	DUNDAS	Large Bottle	26	18	3	0	0	5	0	13	0	4	9	0.5	2	4.5
05-Apr-95	HAMILTON	HOTZ	Medium Bottle	2	0	0	2	0	0	0	0	2	0	0	0.25	2	2
06-Apr-95	HAMILTON	HOTZ	Large Bottle	11	9	0	0	0	2	0	8	0	0	3	1.25	2	3
07-Apr-95	STONEY	HOME	Large Bottle	1	1	0	0	0	0	0	1	0	0	0	0.25	2	1
07-Apr-95	STONEY	KENORA	Multple Bottles	22	12	0	6	0	4	0	12	5	0	5	4.5	2	5
10-Apr-95	HAMILTON	HOTZ	Small Bottle	15	10	1	0	0	4	0	8	0	0	7	0.5	2	4
11-Apr-95	HAMILTON	HOTZ	Small Bottle	13	11	0	0	0	2	0	9	0	0	4	0.5	2	5.5
12-Apr-95	HAMILTON	HOTZ	Small Bottle	6	3	0	0	0	3	0	5	0	0	1	0.5	2	3.5
13-Apr-95	HAMILTON	HOTZ	Small Bottle	1	0	0	1	0	0	0	0	1	0	0	0.5	1	4
17-Apr-95	HAMILTON	HOTZ	Small Bottle	14	10	0	3	0	1	0	6	1	0	7	1.5	2	5.5
18-Apr-95	HAMILTON	HOTZ	Small Bottle	5	5	0	0	0	0	0	3	0	2	0	0.5	2	1.5
19-Apr-95	HAMILTON	OTTAWA	Multple Bottles	31	17	1	1	2	10	0	20	1	1	9	6.75	1	8
20-Apr-95	HAMILTON	HOTZ	Large Bottle	21	19	0	0	0	2	0	11	0	0	10	0.75	2	6.5
03-May-95	STONEY	KENORA	Multple Bottles	4	4	0	0	0	0	0	3	0	0	1	0.75	2	1
09-May-95	HAMILTON	HOTZ	Multple Bottles	4	0	0	4	0	0	0	0	3	0	1	2	2	1.5
11-May-95	HAMILTON	HOTZ	Multple Bottles	7	0	0	0	7	0	0	7	0	0	0	0.75	2	2
18-May-95	HAMILTON	HOTZ	Multple Bottles	3	0	0	2	0	1	0	0	3	0	0	3.75	2	2.5
19-May-95	HAMILTON	HOTZ	Multple Bottles	4	0	0	2	2	0	0	2	1	0	1	0.75	2	1
23-May-95	HAMILTON	HOTZ	Multple Bottles	7	6	1	0	0	0	0	4	0	0	3	1.75	2	2
30-May-95	DUNDAS	DUNDAS	Multple Bottles	6	3	2	0	0	1	0	5	0	0	1	0.5	2	1.5
29-May-95	FLAMBORO	HOTZ	Multple Bottles	8	6	0	0	0	2	0	5	0	0	3	0.25	2	3
31-May-95	HAMILTON	HOME	Small Bottle	2	2	0	0	0	0	0	2	0	0	0	0.5	2	2
02-Jun-95	FLAMBORO	HOTZ	Multple Bottles	2	0	0	2	0	0	0	0	1	0	1	0	2	1
05-Jun-95	DUNDAS	DUNDAS	Multple Bottles	1	0	0	1	0	0	0	0	1	0	0	0.5	2	0.5
09-Jun-95	HAMILTON	HOTZ	Small Bottle	3	0	0	0	3	0	0	2	0	0	1	0.5	2	2
12-Jun-95	HAMILTON	HOTZ	Multple Bottles	11	10	0	0	0	1	0	7	0	0	4	1	2	2

TABLE 3.10: HALOZONE BLUE BOTTLE RECOVERY SUMMARY
CFC Removal Demonstration Project Final Report

Date:	Area:	Site:	Method:	Total No.:	L.Fridge:	S.Fridge:	A/Cs:	Dehum:	Freez:	Other:	R-12:	R-22:	R-Other:	Empty:	Weight(lbs):	Techs:	Hours:
15-Jun-95	HAMILTON	HOME	Large Bottle	9	6	0	0	0	3	0	6	0	0	3	2	2	5
15-Jun-95	HAMILTON	HOTZ	Large Bottle	9	7	0	0	0	2	0	9	0	0	0	2.5	2	3
16-Jun-95	HAMILTON	HOTZ	Large Bottle	11	8	1	0	0	2	0	6	0	1	4	2.75	2	3
19-Jun-95	HAMILTON	HOTZ	Large Bottle	10	7	1	0	0	2	0	9	0	0	1	1.75	2	3.5
TOTAL:	47			457	320	13	25	14	85	0	289	19	8	141	52.05		155.5

TABLE 3.11: THERMAFLO UNIT RECOVERY SUMMARY

CFC Removal Demonstration Project Final Report

Date:	Area:	Site:	Method:	Total No.:	L.Fridge:	S.Fridge:	A/Cs:	Dehum:	Freez:	Other:	R-12:	R-22:	R-Other:	Empty:	Weight(lbs):	Techs:	Hours:
03-Jan-95	HAMILTON	HOTZ	Recovery Tank	5	5	0	0	0	0	0	0	0	0	5	0	3	3
22-Dec-94	HAMILTON	HOTZ	Recovery Tank	5	5	0	0	0	0	0	0	0	0	5	0	3	2.5
01-Feb-95	HAMILTON	HOTZ	Recovery Tank	2	2	0	0	0	0	0	0	0	0	2	0	3	3.5
22-Mar-95	HAMILTON	OTTAWA	Recovery Tank	27	16	1	2	0	8	0	13	0	1	13	1.75	2	6.5
23-Mar-95	STONEY	KENORA	Recovery Tank	26	16	0	0	0	10	0	16	0	0	10	0.75	2	6.5
24-Mar-95	HAMILTON	HOTZ	Recovery Tank	11	9	1	0	0	1	0	8	0	0	3	0.25	2	3.5
27-Mar-95	HAMILTON	HOTZ	Recovery Tank	6	3	0	0	0	3	0	1	0	0	5	0	2	3
28-Mar-95	HAMILTON	HOTZ	Recovery Tank	5	5	0	0	0	0	0	1	0	0	4	0	2	3.5
29-Mar-95	HAMILTON	HOTZ	Recovery Tank	8	4	1	0	0	3	0	4	0	0	4	0.25	1	5.5
30-Mar-95	HAMILTON	HOTZ	Recovery Tank	4	0	0	4	0	0	0	0	4	0	0	4.25	2	4
31-Mar-95	HAMILTON	OTTAWA	Recovery Tank	13	9	2	0	0	2	0	10	0	0	3	0.5	1	3.5
03-Apr-95	HAMILTON	HOTZ	Recovery Tank	6	6	0	0	0	0	0	2	0	1	3	0	2	4
21-Apr-95	HAMILTON	HOTZ	Recovery Tank	6	6	0	0	0	0	0	6	0	0	0	0.25	2	3
24-Apr-95	HAMILTON	HOTZ	Recovery Tank	5	5	0	0	0	0	0	1	0	0	4	0	2	1.5
25-Apr-95	HAMILTON	HOTZ	Recovery Tank	2	1	0	0	0	1	0	0	0	0	2	0	2	2
26-Apr-95	HAMILTON	HOTZ	Recovery Tank	12	8	2	0	0	2	0	11	0	0	1	1.25	2	3
27-Apr-95	DUNDAS	DUNDAS	Recovery Tank	14	9	0	0	0	5	0	9	0	0	5	0.25	2	3.5
03-May-95	STONEY	KENORA	Multple Bottles	16	12	0	0	0	4	0	10	0	1	5	0.75	2	2.5
05-May-95	HAMILTON	HOTZ	Recovery Tank	17	12	0	0	0	5	0	9	0	1	7	2	2	3.5
08-May-95	HAMILTON	OTTAWA	Recovery Tank	30	19	0	1	1	9	0	23	1	0	6	5	1	8
09-May-95	HAMILTON	HOTZ	Multple Bottles	12	11	0	0	0	1	0	8	0	0	4	0.75	2	2
10-May-95	HAMILTON	HOTZ	Recovery Tank	8	4	0	0	4	0	0	6	0	0	2	1.25	2	4.5
11-May-95	HAMILTON	HOTZ	Multple Bottles	15	13	0	0	0	2	0	11	0	0	4	1.5	2	2.5
12-May-95	STONEY	HOME	Recovery Tank	2	1	0	0	0	1	0	2	0	0	0	0.5	2	2.5
15-May-95	DUNDAS	DUNDAS	Recovery Tank	24	18	1	0	2	3	0	20	0	1	3	4	2	6.5
16-May-95	HAMILTON	HOTZ	Recovery Tank	7	6	0	0	1	0	0	5	0	0	2	0.75	2	1.5
17-May-95	HAMILTON	HOTZ	Recovery Tank	20	11	3	0	1	5	0	14	0	0	6	1.5	2	5
18-May-95	HAMILTON	HOTZ	Multple Bottles	12	12	0	0	0	0	0	9	0	0	3	1.25	2	3
19-May-95	HAMILTON	HOTZ	Multple Bottles	9	5	0	1	0	3	0	9	0	0	0	2.5	2	1.5
23-May-95	HAMILTON	HOTZ	Multple Bottles	12	7	0	0	0	5	0	9	0	0	3	1.5	2	2
30-May-95	DUNDAS	DUNDAS	Multple Bottles	12	11	0	0	0	1	0	10	1	0	1	2.75	2	2.5
30-May-95	HAMILTON	OTTAWA	Multple Bottles	15	7	2	3	0	3	0	10	2	0	3	3.25	2	4
29-May-95	FLAMBORO	HOTZ	Multple Bottles	8	7	1	0	0	0	0	5	0	0	3	0.75	2	3
31-May-95	FLAMBORO	HOTZ	Recovery Tank	3	3	0	0	0	0	0	3	0	0	0	1.5	2	1
01-Jun-95	FLAMBORO	HOTZ	Recovery Tank	22	14	0	0	1	7	0	18	0	0	4	5.25	2	6
02-Jun-95	FLAMBORO	HOTZ	Multple Bottles	9	8	1	0	0	0	0	8	0	0	1	2.5	2	3.5
05-Jun-95	DUNDAS	DUNDAS	Multple Bottles	21	17	0	0	0	0	4	16	0	0	5	2.75	2	6.5
06-Jun-95	HAMILTON	HOTZ	Recovery Tank	30	22	1	0	2	5	0	25	0	0	5	5.75	2	8
07-Jun-95	STONEY	KENORA	Multple Bottles	24	15	2	4	0	3	0	15	3	0	6	6	2	5.5
07-Jun-95	HAMILTON	OTTAWA	Multple Bottles	3	0	0	3	0	0	0	0	2	0	1	2.25	2	2
08-Jun-95	HAMILTON	OTTAWA	Multple Bottles	12	3	0	9	0	0	0	3	9	0	0	7.25	2	5.5
12-Jun-95	HAMILTON	HOTZ	Multple Bottles	3	3	0	0	0	0	0	2	0	0	1	0	2	1
13-Jun-95	HAMILTON	HOTZ	Recovery Tank	4	3	0	0	0	1	0	1	0	0	3	0.25	2	2

TABLE 3.11: THERMAFLO UNIT RECOVERY SUMMARY
CFC Removal Demonstration Project Final Report

Date:	Area:	Site:	Method:	Total No.:	L.Fridge:	S.Fridge:	A/Cs:	Dehum:	Freez:	Other:	R-12:	R-22:	R-Other:	Empty:	Weight(lbs):	Techs:	Hours:
08-Jun-95	FLAMBORO	HOTZ	Recovery Tank	11	8	0	0	1	2	0	8	0	0	3	1	2	2.5
09-Jun-95	FLAMBORO	HOTZ	Recovery Tank	3	3	0	0	0	0	0	2	0	0	1	0.5	2	2
14-Jun-95	HAMILTON	HOTZ	Recovery Tank	6	4	1	0	0	1	0	6	0	0	0	0.75	2	4
20-Jun-95	HAMILTON	HOTZ	Recovery Tank	11	1	0	9	0	0	1	0	8	0	3	9	2	3.5
21-Jun-95	HAMILTON	OTTAWA	Multple Bottles	26	15	1	3	1	6	0	21	3	0	2	8	2	8
22-Jun-95	HAMILTON	HOTZ	Recovery Tank	12	8	0	0	0	4	0	10	0	0	2	1.75	2	3.5
23-Jun-95	DUNDAS	DUNDAS	Multple Bottles	21	15	1	2	0	3	0	17	2	0	2	9	2	7
28-Jun-95	HAMILTON	HOME	Recovery Tank	2	1	0	0	0	1	0	2	0	0	0	0.5	2	3
26-Jun-95	HAMILTON	HOTZ	Recovery Tank	14	4	0	0	8	2	0	12	0	0	2	2	2	3
27-Jun-95	HAMILTON	HOTZ	Recovery Tank	19	11	2	0	1	5	0	15	0	0	4	2.5	2	4
28-Jun-95	STONEY	KENORA	Recovery Tank	20	18	0	0	0	2	0	16	0	0	4	2.5	2	4
29-Jun-95	HAMILTON	HOME	Recovery Tank	4	2	0	0	0	2	0	4	0	0	0	2	2	3
29-Jun-95	HAMILTON	HOTZ	Recovery Tank	15	11	1	0	0	3	0	11	0	0	4	0.5	2	3
30-Jun-95	DUNDAS	DUNDAS	Multple Bottles	16	6	0	6	0	4	0	7	6	0	3	3.5	2	4
30-Jun-95	HAMILTON	OTTAWA	Multple Bottles	17	10	3	2	0	2	0	11	1	1	4	2.25	2	3.5
04-Jul-95	HAMILTON	HOTZ	Recovery Tank	30	22	1	0	1	6	0	25	0	0	5	5.5	2	7.5
05-Jul-95	FLAMBORO	HOTZ	Recovery Tank	16	16	0	0	0	0	0	13	0	0	3	3	2	5.5
05-Jul-95	HAMILTON	HOTZ	Multple Bottles	5	2	0	2	0	1	0	3	2	0	0	2	2	2
06-Jul-95	FLAMBORO	HOTZ	Recovery Tank	21	21	0	0	0	0	0	18	0	0	3	3	2	7.5
07-Jul-95	FLAMBORO	HOTZ	Recovery Tank	21	10	0	0	0	11	0	18	0	0	3	3	2	7.5
10-Jul-95	FLAMBORO	HOTZ	Multple bottles	21	0	0	12	7	2	0	8	10	0	3	5.75	2	7.5
TOTAL:	64			818	541	28	63	31	150	5	560	54	6	198	141		253.0

4.0 OBSERVATIONS AND DISCUSSION

4.1 Progress Report Observations

The following observations were taken from the monthly progress reports, which identified any problems or concerns that were encountered during the operation of the project. Also listed is the course of action taken for each instance, to offset the problems.

Observation	Action Taken
CFC-bearing white goods were taken from curbside by scavengers before Hotz trucks arrived. The scavenging rate for the study was approximately 45% of all white goods scheduled for pick-up. As expected, few white goods were being discarded in February and March.	Hotz will make recommendations later in this report regarding scavenging.
The double-axle, box van initially assigned as the truck for curbside collection by Hotz was found to be larger than required and difficult to manoeuvre on city streets. The truck had the capacity to properly transport 40-50 upright appliances.	A smaller, single-axle box van was purchased by Hotz in March and was designated for curbside collection. This truck has the capacity to properly transport 25-30 upright appliances.
Several problems with recovery equipment failure and breakage occured throughout the study. Both of the recovery units needed to be repaired at various times during the five months. These problems were a result of equipment defects and a lack of knowledge and experience possessed by the operators.	Equipment repairs and servicing were done by the retailers under warranty. In each case, when repairs could not be made immediately, replacement equipment was provided at no cost.
The home service days scheduled for The City of Stoney Creek, were not well co-ordinated. Only 8 homes out of a planned 25 participated in the study. The contractor for The City of Stoney Creek failed to provide adequate notice to Hotz regarding the service schedules.	Four additional home service days were scheduled in The City of Hamilton.

Twelve appliances were found to contain refrigerants other than recoverable CFCs, HCFCs or HFCs (Hydrofluorocarbons). Seven of these were refrigerators which contained sulphur dioxide and five were refrigerators which contained ammonia. In one instance, sulphur dioxide was accidently evacuated because no identification was visible. This error resulted in damage to the Thermaflo recovery unit and the contamination of one recovery tank, containing 5 lbs. of CFC-12 refrigerant.

The make and appearance of these types of appliances were recorded to prevent any reoccurances of this problem. Each of the appliances were tagged and marked DANGER! POISON GAS, before being forwarded to the scrap metal recycling yard. An investigation into possible recovery and recycling methods was determined to be outside the scope of this study.

In a significant number of appliances, compressor oil was also being evacuated. Upon completion of the recovery procedure, large amount of oil would leak on the ground. This leakage was a primary concern when servicing an appliance in the home.

Both equipment retailers assured us that oil recovery was normal and would not effect the recycling process. To prevent spills on the ground and floor, absorbant pads were placed under the appliance and wrapped around the puncture hole after evacuation.

For this project, no CFC-bearing white goods were collected from The Town of Ancaster or The Township of Glanbrook. Ancaster had bulk collection days scheduled during the period of this study, but reported that no CFC-bearing white goods were available at curbside on those designated days. The Township of Glanbrook had a contractor on call for pick-ups. He reported that all appliances were scavenged prior to his arrival.

Hotz concluded that this poor result could be attributed to scavenging or a lack of commitment by the collection contractor in diverting CFC-bearing white goods for evacuation.

4.2 Discussion

Weather

One of the primary concerns when planning this study was the effect that extreme weather and temperatures would have on the recovery effectiveness. For this reason, one of the criteria for purchasing equipment was efficiency at most temperatures. A feature built into many of the recovery units is sub-cooling, which prevents high pressure build-up in the recovery tanks and decreases recovery time. The weather was also a factor for our technicians, who were on call to service appliances at the three transfer stations, regardless of the weather conditions. Hotz decided that it was necessary to build an insulated and heated operations room for the evacuation of CFCs at the Hotz facility. The majority of the recovery services were done in this room.

During the period of the study, Hotz technicians performed evacuation in all types of weather: rain, snow, temperatures exceeding 40 degrees Celsius and temperatures below -20 degrees Celsius. This range was essential to test the capabilities of each of the recovery methods. In each case, the evacuation process did not appear to be affected. Recovery rates were lower in the winter months, but it was not determined that temperature was the cause. These lower rates could also be explained by the lack of experience of our technicians in the early winter portion of this study and the fewer number of appliances that were discarded at this time. Evacuation of appliances at the Hotz facility was generally done inside the operations room in cases of extreme weather. This resulted in added appliance handling time and costs.

Data Collection

The work order was regarded by Hotz as the most important tool for collecting data for this study. The work order had to be easy to fill out and designed so that technicians could complete it while collecting or evacuating CFC-bearing white goods. At the same time, one work order must be able to record all types of data collected from any mode of service. Several drafts of the work order were done to satisfy both criteria. In retrospect, the work order was effective in most cases, but slight modifications could be made. The only significant change would be to record the weight of CFCs recovered by refrigerant type (e.g. CFC-12, CFC-22) and recovery method. Confusion was created when multiple recovery cyclinders were used during one service day.

Type of Refrigerant

Another concern that was discussed prior to the study, was how to determine the type of refrigerant found in a white good. Often the white goods being discarded were old and damaged and the refrigerant was not identified. Identification was crucial to recovery because the mixing of different refrigerant types can cause cross-contamination and result in high disposal costs.

Approximately half of the appliances evacuated were marked in some manner to identify the type of refrigerant employed. The most common form was a metal plate located below the main door, on the inside of the appliance or adjacent to the compressor. Other markers include a stamp on the body of the compressor or a sticker attached to the back of the appliance containing a schematic diagram. For appliances which were not marked, two methods were used to identify the refrigerant. The first method was visual recognition of the manufacturer, style or shape of the compressor and cooling system. As the study progressed, the technicians recognized cooling systems and associated them with those containing known refrigerants. The second method used advice given to Hotz by sales agents and service people. Most experts confirmed that almost all refrigerators, freezers and dehumidifiers built in the last half century contain CFC-12, while the majority of household air conditioners contain CFC-22. In cases where the operator was still in doubt, small Blue Bottles (single-service) were to be used and marked unknown.

Quantity of Refrigerant

The average quantity of CFCs that could be expected to be evacuated per appliance, or average recovery rate, was difficult to project prior to the study. It was known that new appliances containing CFCs are charged with between 8 and 32 ounces of refrigerant. It was predicted that a significant number of CFC-bearing white goods being discarded would be empty or damaged. The Rural Ontario Report predicted an average recovery rate of 124 grams or 4.37 ounces per appliance prior to that study, but only achieved a rate of 50.4 grams or 1.78 ounces. Upon completion of this study, the average recovery rate was determined to be 68.6 grams or 2.42 ounces for all goods collected and 103.2 grams or 3.64 ounces for all goods evacuated excluding those predetermined to be empty.

Household air conditioners tended to contain the highest quantities of CFCs with an average of 32 ounces. The next highest charges of refrigerant were found in dehumidifiers, followed by refrigerators and freezers which contained similar quantities which ranged from 8 to 10 ounces. It was also observed that the air conditioners and dehumidifiers being discarded during the study were in better condition than the majority of refrigerators and freezers. Consequently, fewer of these smaller units were found to be empty of refrigerants.

Pre-evacuation Appliance Handling

Appliance handling techniques prior to evacuation of CFCs, were also thought to be a determining factor in the recovery rates for this study. We predicted that the lesser an appliance was handled, the greater the average amount of CFCs recovered would be because damage and leakage were less likely.

Prior to this study, the standard procedures for curbside collection were to load the white good onto a truck or trailer with little regard for protecting the cooling system. Certain programs also involved

the use of a compactor to crush the appliance on site, to occupy less space on the truck or trailer. White goods dropped off by the public at the waste transfer stations were loaded into recycling bins using front-end loaders. Again, care was not taken to protect the appliance and prevent the venting of CFCs to the atmosphere.

During the study period, it was necessary to request that all parties take care in handling CFC-bearing white goods before evacuation and tagging are done. To achieve maximum recovery rates, the appliances were to be handled and stored in the upright position. Householders volunteering for the home service were asked to leave the appliance in or close to its original position. Site operators at the transfer stations were asked to handle and store the CFC-bearing white goods in the upright position and not to place any pressure on the cooling systems. White goods collected by Hotz from the curb were handled in strict accordance with the project operational procedures listed in Appendix G. These procedures were designed to maintain the condition of the appliances during transportation and storage.

Scavenging

Shortly after the project began, an unexpected problem arose that significantly reduced the number of goods available for collection. CFC-bearing white goods that were scheduled for collection by The City of Hamilton, were being taken by scavengers prior to pick-up. This problem continued throughout the study and accounted for approximately 45% of the total white goods discarded by residents.

Scavenging had serious effects on the operating costs and data collection for the study. It significantly reduced the sample size of appliances to be collected and resulted in wasted transportation costs being charged to the project. The collection vehicle was dispatched to each address, but was only picking up half the white goods. Therefore for this study, the curbside collection costs cannot be regarded as representative of the number of goods actually collected.

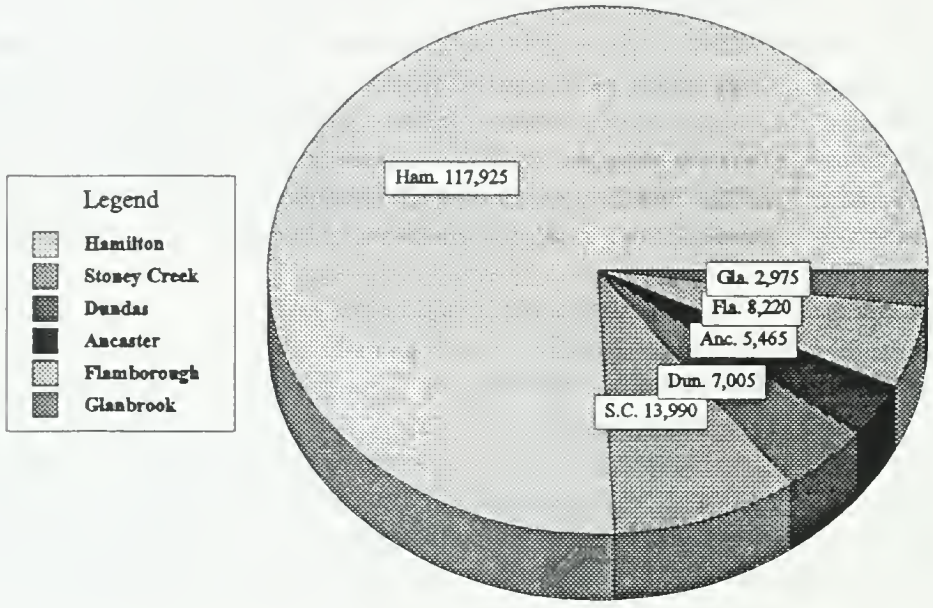
Solutions to this problem should be found if curbside pick-up is considered a desired mode of collection. Hotz determined that there are two possible deterrents to scavenging. This first is to designate collection locations other than curbside. Residents could be asked to leave the appliance on private property or in the home to prevent any unauthorized persons from taking it. The second deterrent involves enforcement of the new regulation by a designated agency.

The Absence of Data from Ancaster and Glanbrook

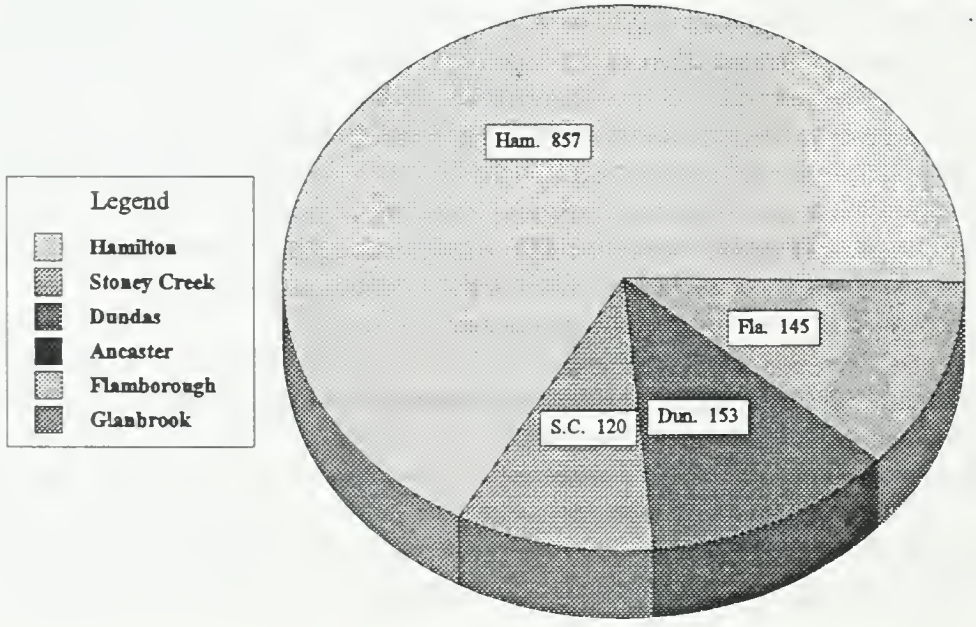
When this study was first proposed, an estimate was made as to the number of CFC-bearing white goods to be serviced, based on the number of households per area municipality and data taken from past years. Graph 4.1 illustrates the actual number of white goods collected during the study period and the breakdown of the number of households per municipality (data taken from Kucsma, Rodman

GRAPH 4.1: White Good Collection Per Area Municipality Summary

DISTRIBUTION OF HOUSEHOLDS



NUMBER OF GOODS SERVICED



and Walker 1994). As the study progressed, there was a lack of data being collected for The Town of Ancaster and The Township of Glanbrook. Both municipalities reported that no appliances containing CFCs were collected during the study period. We can only speculate that this absence was a result of scavenging or a lack of commitment by the contractors to divert CFC-bearing white goods for evacuation. Another possible explanation is that residents from these two municipalities delivered their white goods directly to one of the three waste transfer stations.

Unexpected Costs

Several unexpected costs were encountered during the course of the project. These costs may be applicable to other future programs and studies. As discussed earlier, cement blocks were placed at each of the three regional waste transfer stations at the request of the site operators. Prices were revised by Halozone Recycling Inc., with respect to their Blue Bottle deposit and recovery fees. The final source of unexpected costs came from recovery equipment maintenance and replacement parts. External filter driers, needles for the puncture devices, and vacuum pump oil were all items which required regular replacement. Additional manifold, gauge and hose sets were purchased following the incident involving the evacuation of sulphur dioxide.

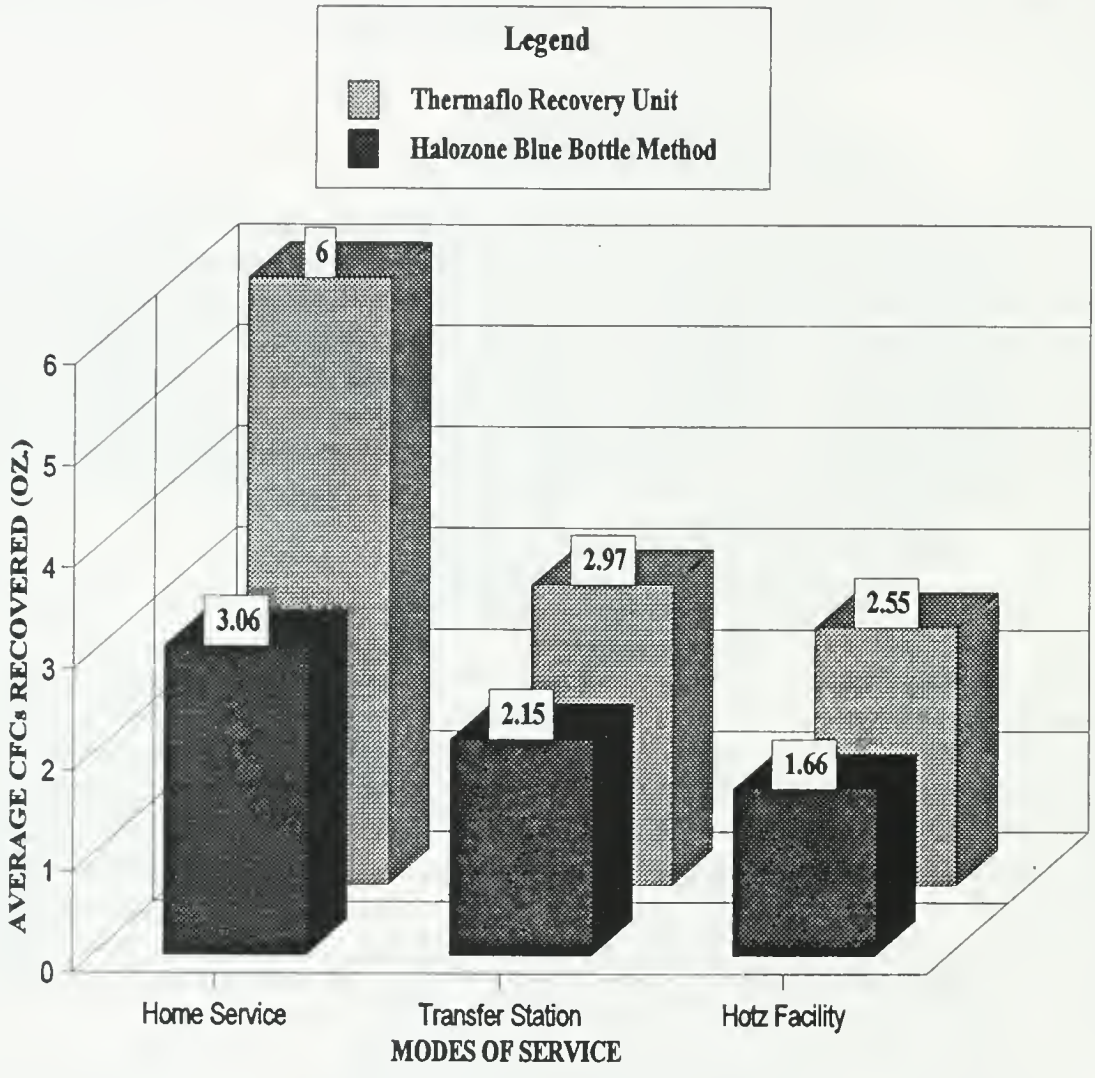
Modes of Service

In order to accurately assess the success of the three modes of white good evacuation chosen for this study, statistics must be calculated from the recovery data and project operating costs. Graph 4.2 has been produced using the data tabulated in Table 3.2, and illustrates the average recovery rates for all three modes of collection and both methods of evacuation. Graph 4.3 also incorporates data from this Table and compares the average evacuation time for each mode of collection and type of evacuation method. The average recovery costs are summarized in Graph 4.4, using calculations made in Table 3.3. These recovery cost summary graphs compare prices based on estimates per appliance and per ounce of CFCs recovered. These are based strictly on operational costs and do not include capital or administration costs associated with the study. All applicable taxes were also not included.

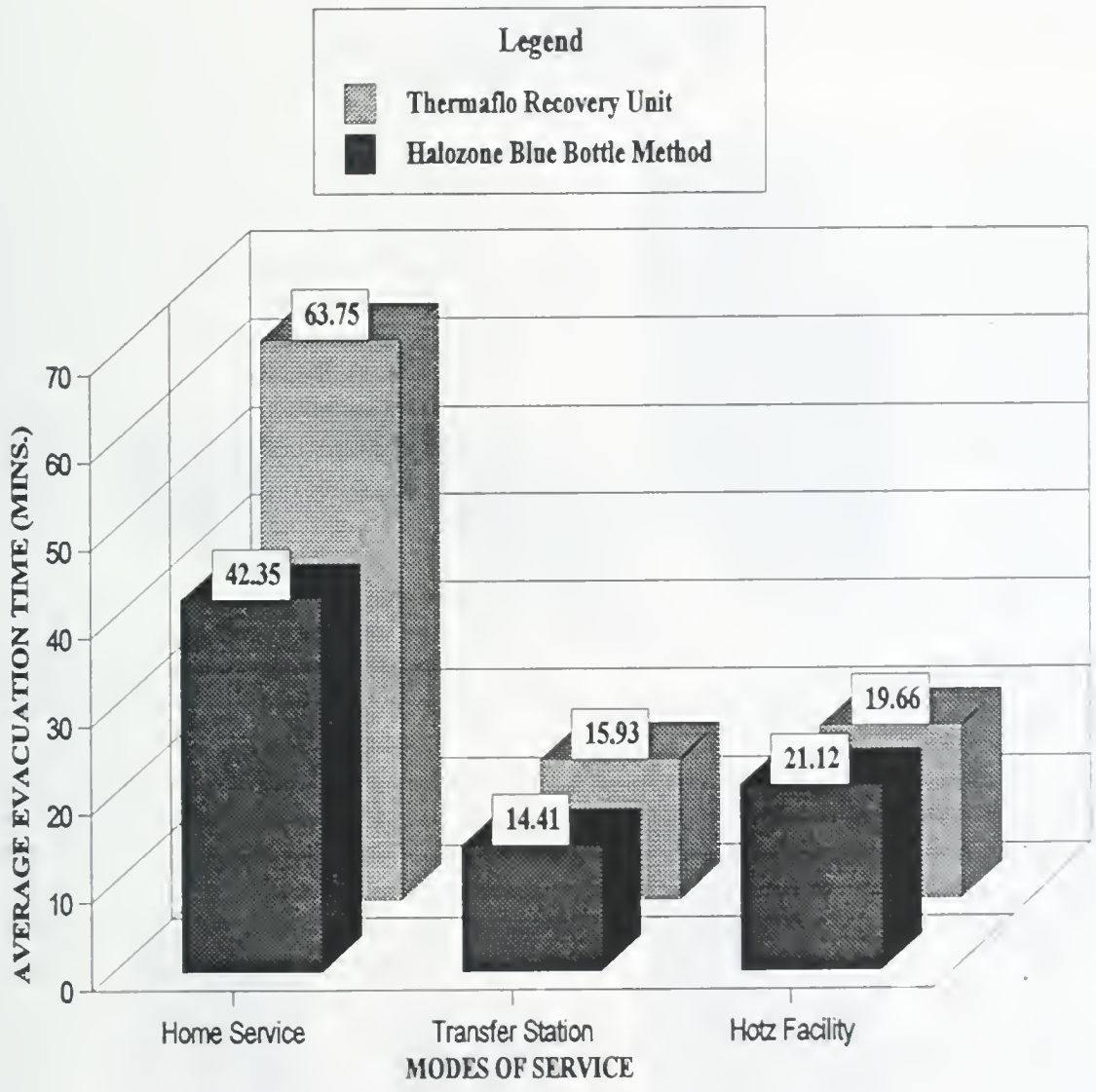
The home services were successful in achieving the highest average recovery rates. However, this mode was by far the most expensive and time consuming. From an environmental standpoint, home service was proven to be effective, but from an economical standpoint, this collection and recovery mode is not practical (averaged $79.00 per appliance). This approach was the only service mode where access to the appliances was a problem. After permission was given by the householder, he or she was required to be home at a certain time to provide access for the technicians. A great deal of co-ordination was required between the householder, the municipality and the contractor before a program like this one could be successful.

Based on the data collected from this study, the transfer station mode of collection and recovery

GRAPH 4.2: Average CFCs Recovery Rates Comparison



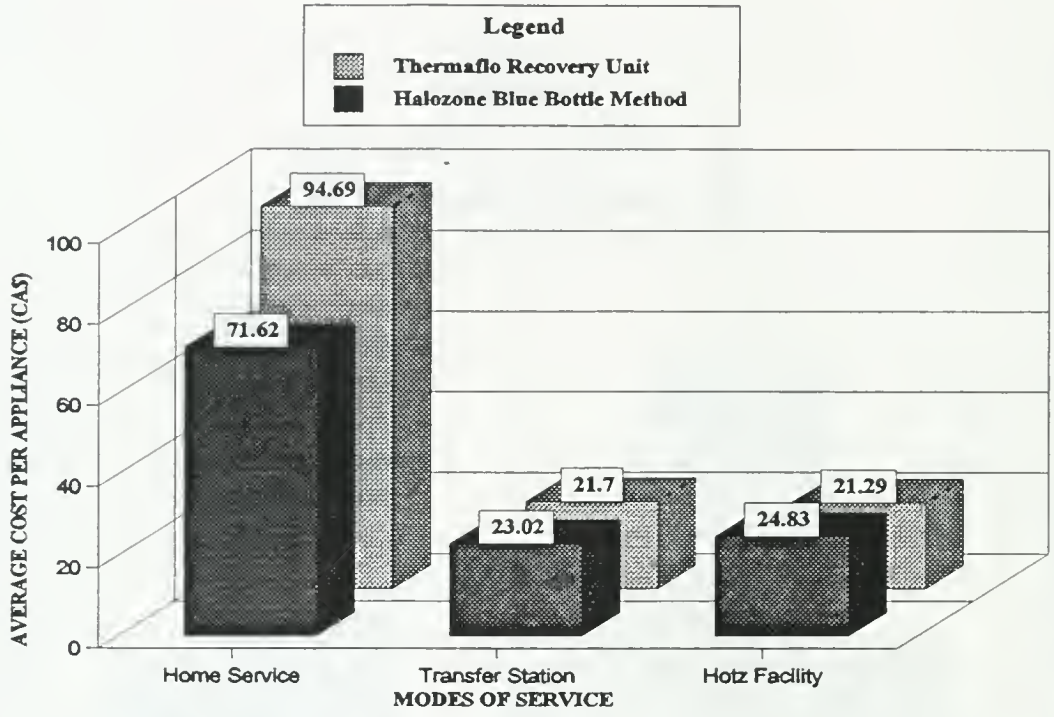
GRAPH 4.3: Average Evacuation Time Comparison

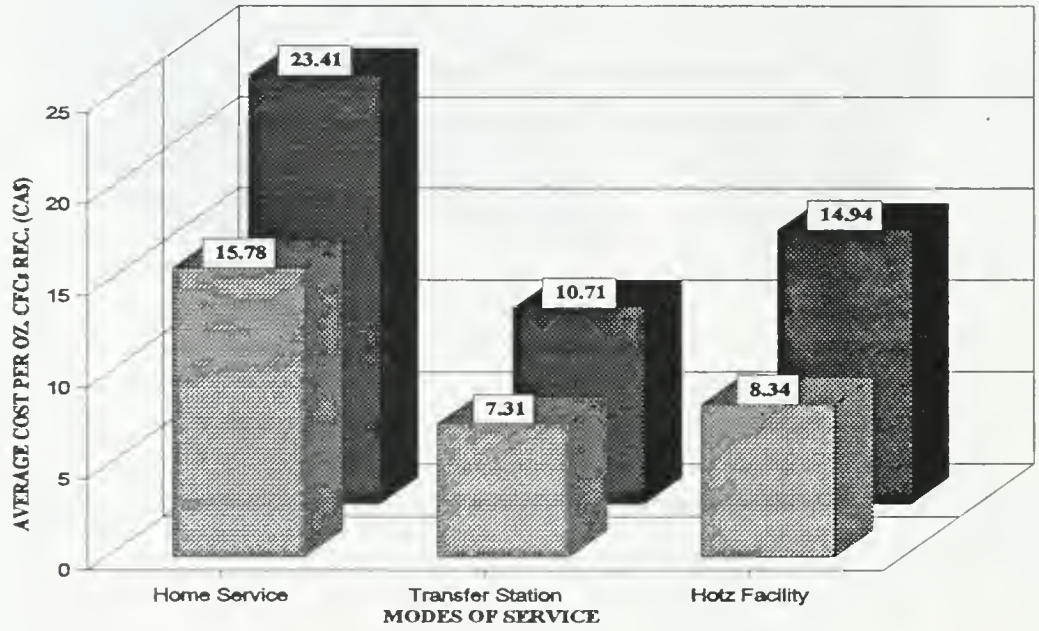


(Note: Transfer Station evacuation times do not include appliance handling)

GRAPH 4.4: Average Recovery Costs Comparison

(Costs do not include applicable taxes)





(Note: Transfer Station costs do not include appliance handling)

appears to be best suited for a community of this size and structure. Evacuation at the transfer stations achieved the next highest average recovery rates and the lowest average evacuation times. The average costs calculated for this mode of service were generally the lowest of the three tested. There may, however, be hidden costs associated with the transfer station operation. These estimates do not include appliance handling which can significantly increase recovery times and recovery costs. Appliance handling at the transfer stations was the responsibility of the site operators and the data was not made available to Hotz for this study.

Results from the operations at the Hotz facility, are similar to the transfer station findings. The average evacuation times and the average recovery costs are slightly higher than those of the transfer station mode, but comparable. The minor differences may be explained by any of the following reasons. Hotz was responsible for appliance handling at our facility and reported costs associated with this task. A large proportion of the total white goods serviced at the Hotz facility were moved to the operations room as opposed to evacuating appliances in place at the transfer stations. The total number of goods serviced at the Hotz facility was significantly larger than the totals for any other recovery location, meaning that the data may be more accurate and representative. Finally, evacuation at the Hotz facility began in January, while evacuation at the transfer stations did not begin until March.

Type of Recovery Equipment

In our assessment of the effectiveness of the two types of recovery equipment chosen for the study, we had to consider the data collected, the ease of operation and the overall efficiency of each product.

Based on this study, the evacuation data clearly shows that the Thermaflo recovery unit was the more effective method. Although the average evacuation times were slightly higher than the Halozone method, the Thermaflo unit yeilded higher average recovery rates and was significantly cheaper to operate. The longer evacuation time can be related to the additional period of training required by the technicians to operate this equipment. Once the technicians became familiar with the technical aspects of the unit, evacuation times were reduced.

The Thermaflo unit was more expensive to purchase, but does not have the associated recovery fees that come with the Halozone Blue Bottle method. Non-contaminated refrigerant is purchased by reclaimers at a cost of $2.00 per kilogram of CFC-12 and $1.00 per kilogram of CFC-22. This can help offset recovery costs but was not included in the cost calculations for this study. It should be mentioned that the customer service given to Hotz was exceptional for the Thermaflo recovery unit. Both the supplier, TF Industries, and the retailer, Frontier Climaref, provided tremendous assistance throughout the study.

The Halozone Blue Bottle equipment was proven in this study to be a quick, simple-to-use evacuation method, but generally produced lower recovery rates and was more expensive to operate. The capital costs to purchase this equipment are cheaper because Blue Bottles are rented not purchased. The

option of using the small, single-service, Blue Bottles was an asset to the recovery program when confronted with unknown or uncommon refrigerants. The Halozone method also provided fast, quiet evacuation for in home recovery, where public perceptions are important. Unlike the Thermaflo method, a processing fee must be paid to Halozone for every full bottle returned.

Scrap Metal Recycling

One final consideration must be given to the value of scrap metal that can be salvaged from the disposal of household white goods. The market value of scrap metal and more specifically white goods, is constantly changing. For the duration of this study, the rate ranged from $40.00 to $65.00 per metric tonne. This income can assist in offsetting collection and evacuation costs.

5.0 CONCLUSIONS

The following conclusions that were drawn for this study, were based on the data collected and the statistics calculated from the CFC Removal Demonstration Project, operated in The Regional Municipality of Hamilton-Wentworth:

Extreme weather conditions were determined not to be a factor in the evacuation of CFCs from domestic white goods, just an inconvenience.

In most cases, identification of the types of refrigerant contained in an appliance was possible. The majority of domestic, CFC-bearing white goods utilize CFC-12 and CFC-22. Refrigerants that could not be identified were handled separately and evacuated using small Halozone Blue Bottles (single-service).

Based on data collected from this study, the average amount of CFCs recovered per household white good was 2.42 ounces or 68.6 grams. This rate is higher than the rate achieved by the Rural Ontario program.

Time and money were wasted because 45% of all the discarded, CFC-bearing white goods during the study period, were taken by scavengers prior to curbside pick-up. Scavenging reflects a realistic problem for the operation of a cost effective, curbside collection program. It also presents a real challenge to the implementation of the new regulation.

Home service was proven to be the ideal mode of service from an environmental standpoint, maximizing CFCs recovery rates.

Several additional maintenance costs can be expected when implementing a white goods collection and recovery program of this nature.

The transfer station was determined to be the most efficient mode of service tested by this study. Results showed that data collected in this mode attained the lowest average evacuation times and the cheapest average recovery costs. These results do not consider the additional time and costs associated with appliance handling at these sites.

The Hotz facility mode of service, incorporating one central collection depot, achieved similar results to those of the transfer stations. These results have a higher validity because twice the amount of data was collected for this mode of service and all operating costs have been included.

While the Halozone Blue Bottle method was proven to be easier and faster to operate, the Thermaflo recovery unit was concluded to be the most effective, with respect to the average recovery (capture) rates, average evacuation costs and overall customer service.

Collection and evacuation costs for a program of this type can be offset by profits received through scrap metal and CFCs recycling.

6.0 RECOMMENDATIONS

Each region or municipality in the process of developing a CFC recovery/evacuation program, must first address its own specific circumstances and needs. For this reason, Hotz Environmental Services Inc. suggests that recommendations made by this study cannot be regarded as universal and should be left for the reader to determine using the data and statistics presented.

Data collected from this study showed that approximately one quarter to one third of CFCs used by domestic white goods was still available for recovery after the appliance had been discarded. Household air conditioners were generally found to be intact, containing most of their original charge of refrigerant (up to 32 ounces). Considering these results and the number of CFC-bearing appliances in use in Ontario today, Hotz resolved that these goods contribute a significant portion of the CFCs potentially released to the atmosphere.

The associated costs with implementing a recovery program are dependant on the mode of service chosen and the levels of data collection required by a specific region. In most cases, collection and disposal methods are already in place for domestic white goods. Therefore the costs calculated from this study only reflect operating costs for CFC recovery/evacuation.

A home service recovery program for The Regional Municipality of Hamilton-Wentworth was concluded to cost approximately $79.00 per unit or $718.00 per metric tonne of white goods.

A program which utilizes central collection depots (waste transfer stations or Hotz facility) was concluded to cost approximately $22.00 per unit or $200.00 per metric tonne of white goods.

Hotz does recommend that this or another study of this type should be continued for a longer duration, in order to collect more representative and conclusive data. It would also be beneficial to calculate and compare statistics from all four seasons.

7.0 REFERENCES

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APPENDIX A

Ontario Regulation 189/94

APPENDIX B

Sample Work Order and Tag

Hotz Environmental Services Inc.

Head Office:
239 Lottridge Street
Hamilton, Ontario L8L 6W1

Local: (905) 545-2665
Toronto: (905) 842-8734
Facsimile: (905) 545-7822

Work Order

Service Date _____

(CFC PILOT STUDY)

Generator:	Recovery Site:
Address:	Site Address:
Telephone:	Carrier:
Hotz Code:	Metal Recycler:

Recovery: _____ Transport: _____	Type of service: Home Service _____ Transfer Station _____ Hotz Facility ____ Transport ____
Method used: Recovery Unit: _____ Blue Bottle: _____	
No. of Appliances:	No. of Technicians:
Type: Large Fridge ____ Air cond. _____ Freezer ___ Small Fridge ____ Hum/Dehum_____ Other ___	Vehicle used:
Type of Refrigerants: R12 ___ R22 ___ R500 ___ R134A ___ Other ___ Empty / Damage ___	Appliance Handling Equipment: _____ hrs
No. of Blue Bottles Used: Small _____ Large _____	Supplies Used:
No. of Recovery Bottles Used: _____	
Total Weight of Refrigerant Recovered: _____ lbs	

Comment:

Time In: _____ am/pm Time Out _____ am/pm

Generator/Authorized Personnel : _____

Technician: _____

Dedicated to the Environment. Committed to the Future.

Hotz Environmental Services Inc.

239 Lottridge St., Hamilton, ON L8L 6W1 • (905) 545-2665

Technician	Date of Service
Certificate No.	Type of Refrigerant
Expiry Date	Hotz Code

This appliance is certified to be CFC free.

_____

Technician

APPENDIX C

Recovery Equipment Comparison Chart

RECOVERY EQUIPMENT COMPARISON CHART
CFC Removal demonstration Project Final Report

Recovery Equipment:	Compressor Type:	Sub Cooling:	Size: Weight:	Vacuum:	Cost: (tax not included)	Special Features:	Contact:
Thermaflo OZ4000 Saver Light	1 Horsepower Oil-less	yes Manual	12x11x13" 34 lbs.	20" Hg	$2,099 not including tank	Oil-less (no disposal) Toll free service line	Dave Hurley TF Industries (905) 454-8878
Ridgid RS200	1/3 Horsepower Copeland	yes Manual	n/a 53 lbs.	10" Hg	$1,999 includes 50 lb. tank	No oil separation req'd Lifetime warranty	Greg Yellowlees Ridge Tool Co. (905) 880-1687
Copeland PC-1	1/3 Horsepower Copeland	yes Automatic	13x22.5x10.75" 53 lbs.	10" Hg	$1,950 includes 50 lb. tank	Automatic vapour and liquid recovery	Jeff Stroud Eastern Refrigeration (905) 560-1931
Robinair 17650A	1/3 Horsepower	no	19 25x20.5x8.25" 55 lbs.	10" Hg	$2,057.40 includes 30 lb. tank		Kerry Jentz Frontier Climaref (905) 578-4626
Halozone Blue Bottle System with Robinair 15400 Vacuum Pump	1/3 Horsepower	not required, bottles not under pressure	15.5x5.5x9.75" 29 lbs.	10" Hg	$415.00 vacuum pump $235.00 accessories bottle user fees: three sizes, small $10.50, medium $55.00, large $108.50	Oil not contaminated No pressure in system	Brian Veitch Halozone Recycling (905) 405-8200

APPENDIX D

Recovery Equipment Sales Brochures

APPENDIX E

Recovery Equipment Inventory List

RECOVERY EQUIPMENT INVENTORY LIST

RECOVERY EQUIPMENT:			<u>Price (CA$)</u>
- Thermaflo OZ4000 Saver Light recovery unit			$2,488.97
- Halozone Equipment (incl. Robinair 15400 Vacuum Pump)			$1,236.56
RECOVERY CYLINDERS:			
- Anachemia recovery tanks (Thermaflo), 50 lbs. capacity		$140.00 x 5	$700.00
- Halozone Blue Bottles deposit -	Small	$25.00 x 5	$125.00
	Medium	$125.00 x 1	$125.00
	Large	$250.00 x 1	$250.00
ACCESSORY RECOVERY EQUIPMENT:			
- Valve Manifold Gauge Set (1)			$154.66
- Valve Manifold Gauge and Hose Set (1)			$212.32
- Insta-tap Replacement Needles (16)			$190.08
- Vacuum Pump Oil - 4 Litres (2)			$64.12
- Hose Set (1)			$135.30
- Sporlan In-Line Filter Driers (6)			$139.56
ACCESSORY SERVICE EQUIPMENT:			
- Portable Generator			$1,402.92
- Appliance Dolley (2)			$428.71
- Tool Box and Tools			$110.11
- Weights for Scale			$17.28
TOTAL:			$7,780.59

(All applicable taxes are not included)

APPENDIX F

Site Modifications Inventory

SITE MODIFICATIONS INVENTORY

HOTZ FACILITY:	**Price (CA$)**
- Lumber supplies	$1,444.55
- Door lock system	$133.80
- Baseboard heaters	$95.26
- Fluorescent lighting	$53.89
- Electrical services	$635.54
TRANSFER STATIONS:	
- Cement block (32)	$518.40
- Placement and Removal of blocks	
Truck - $65.00 x 48 hrs.	$3,120.00
Driver - $22.50 x 48 hrs.	$1,080.00
TOTAL:	**$7,081.44**

(All applicable taxes are not included)

APPENDIX G

Project Operational Procedures

CFC Removal Demonstration Project
OPERATIONAL PROCEDURE

MODE OF SERVICE: **Transport of CFC-bearing White Goods**

PURPOSE: To safely transport all CFC-bearing, household white goods to a designated facility for the recovery of CFC refrigerant, prior to disposal and/or metal recycling.

EQUIPMENT: Truck, appliance dolley, restraint straps, duct tape, coveralls, gloves, work boots, safety glasses.

SAFETY PROCEDURE: Wear protective equipment at all times. Always use appliance dolley to move heavy appliances. To avoid leaks, do not bang or apply pressure to the cooling systems. If a white good is leaking and emitting a strong, foul odour, do not attempt to transport.

PROCEDURE: Load truck with required equipment.

Upon arrival at site, locate white good(s). If it is not visible, attempt to contact homeowner.

Secure all loose wires and cords with duct tape.

To move white good, approach with appliance dolley from side rather than back to avoid damaging the cooling system. Tilt the white good and slide the dolley underneath. Apply pressure to the dolley with foot and pull back. Always move the white good in the upright position. Place the white good down on the tailgate of the truck and remove the dolley.

Load the truck using tailgate lift. Place goods near the front of the truck in the upright position. Do not put pressure on the cooling systems usually located on the backs of white goods.

Once white good(s) is loaded, restrain using straps to prevent movement during transport. Secure tailgate and doors.

Return to recovery facility for the evacuation of CFC refrigerant. Unload white good(s) in same manner to a designated storage area. Store in an upright position.

CFC Removal Demonstration Project
OPERATIONAL PROCEDURE

MODE OF SERVICE: **In-Home Recovery of CFC Refrigerant**

PURPOSE: To safely remove all CFC refrigerant from household white goods prior to disposal and/or metal recycling.

EQUIPMENT: Truck, CFC recovery equipment, appliance dolley, absorbent pads, portable generator, extension cord, tags, logbook, garbage bags, coveralls, gloves, work boots, safety glasses, identification cards, scale.

SAFETY PROCEDURE: Wear protective equipment at all times. Always use appliance dolley to move heavy appliances. To avoid leaks, do not bang or apply pressure to the cooling systems. If a white good is leaking and emitting a strong, foul odour, do not attempt to recover refrigerant.

PROCEDURE: Load truck with required equipment.

Upon arrival at site, establish contact with homeowner. Show proper identification if requested.

Locate the white good(s). Retrieve equipment from truck and set up adjacent to white good(s).

Turn the white good(s) so that the cooling system is accessible. Tilt the white good and place absorbent pad on the ground or floor under the compressor. Release the white good.

SET UP EQUIPMENT. EVACUATE CFCs FROM WHITE GOOD. Please refer to the operating procedures for the specific recovery method/equipment.

Record data (e.g. type of white good, type of refrigerant, recovery method used) in logbook and on corresponding work order.

Complete TAG and apply to the back of the white good in a secure and visible location.

Remove equipment and return white good to original position. Tape absorbent pad around entry point into the cooling system.

Repeat procedure for next white good if applicable.

Load equipment back into truck and continue to next home if applicable.

Return to Hotz facility at 239 Lottridge Street. Unload equipment to designated storage area. Measure and record the weight of refrigerant recovered for that service day, in the logbook and on the corresponding work order.

CFC Removal Demonstration Project
OPERATIONAL PROCEDURE

MODE OF SERVICE: **Hotz Facility Recovery of CFC Refrigerant**

PURPOSE: To safely remove all CFC refrigerant from household white goods prior to disposal and/or metal recycling.

EQUIPMENT: CFC recovery equipment, appliance dolley, portable generator, extension cord, tags, logbook, fork-lift truck, coveralls, gloves, work boots, safety glasses, scale, absorbent media.

SAFETY PROCEDURE: Wear protective equipment at all times. Always use appliance dolley to move heavy appliances. To avoid leaks, do not bang or apply pressure to the cooling systems. If a white good is leaking and emitting a strong, foul odour, do not attempt to recover refrigerant.

PROCEDURE: Retrieve recovery equipment from designated storage area and set up next to white goods.

Turn the white goods so that the cooling systems are accessible.

SET UP EQUIPMENT. EVACUATE CFCs FROM WHITE GOOD. Please refer to the operating procedures for the specific recovery method/equipment.

Record data (e.g. type of white good, type of refrigerant, recovery method used) in logbook and on corresponding work order.

Complete TAG and apply to the back of the white good in a secure and visible location.

Clean any trace refrigerant or oil from ground using absorbent media. Place waste into garbage bag. Remove recovery equipment.

Repeat recovery procedure for next white good if applicable.

Remove tagged white goods from operation area to designated area for metal recycling using fork-lift.

Return all equipment to designated storage area.

Measure and record the weight of refrigerant recovered for that service day, in the logbook and on the corresponding work order.

CFC Removal Demonstration Project
OPERATIONAL PROCEDURE

MODE OF SERVICE: **Transfer Station (Waste Depot) Recovery of CFC Refrigerant**

PURPOSE: To safely remove all CFC refrigerant from household white goods prior to disposal and/or metal recycling.

EQUIPMENT: Truck, CFC recovery equipment, appliance dolley, absorbent media, portable generator, extension cord, tags, logbook, garbage bags, coveralls, gloves, work boots, safety glasses, identification cards, scale.

SAFETY PROCEDURE: Wear protective equipment at all times. Always use appliance dolley to move heavy appliances. To avoid leaks, do not bang or apply pressure to the cooling systems. If a white good is leaking and emitting a strong, foul odour, do not attempt to recover refrigerant.

PROCEDURE: Load truck with required equipment.

Upon arrival at site, establish contact with site supervisor or operator. Show proper identification if requested. Review all safety procedures with him/her prior to work.

Locate white goods. Retrieve equipment from truck and set up adjacent to white goods.

Turn the white good so the cooling systems are accessible.

SET UP EQUIPMENT. EVACUATE CFCs FROM WHITE GOOD. Please refer to the operating procedures for the specific recovery method/equipment.

Record data (e.g. type of white good, type of refrigerant, recovery method used) in logbook and on corresponding work order.

Complete TAG and apply to the back of the white good in a secure and visible location.

Clean any trace refrigerant or oil from ground using absorbent media. Place waste into garbage bag. Remove recovery equipment.

Repeat procedure for next white good if applicable.

Remove tagged white goods from operation area to a designated area for metal recycling, using appliance dolley. Inform site supervisor before departure that all white goods in designated area have been evacuated.

Return to Hotz facility at 239 Lottridge Street. Unload equipment to designated storage area. Measure and record the weight of refrigerant recovered for that service day, in the logbook and on the corresponding work order.

CFC Removal Demonstration Project
OPERATIONAL PROCEDURE

MODE OF SERVICE: **Recovery of CFC Refrigerant Using Halozone Blue Bottle Method**

PURPOSE: To safely remove all CFC refrigerant from household white goods prior to disposal and/or metal recycling.

EQUIPMENT: Vacuum pump, three charging hoses (yellow, red, blue), manifold gauge set, recovery cylinder H-stand, blue bottles (small-1 lb., medium-5 lbs., large-10 lbs.), brass cylinder fitting, Insta-tap Vicegrips, coveralls, gloves, work boots, safety glasses, portable generator, extension cord, adjustable wrench.

SAFETY PROCEDURE: Wear protective equipment at all times. If a white good is leaking and emitting a strong, foul odour, do not attempt to recover refrigerant. If a white good contains sulphur dioxide (SO2) or ammonia (NH3) as a refrigerant or any other non-CFC refrigerants, do not attempt to evacuate.

PROCEDURE: Plug vacuum pump into portable generator or electrical outlet. Turn ON generator.

Remove all protective caps from terminals.

Screw Blue Bottle clockwise onto recovery H-stand. Remove Blue Bottle cap and screw brass cylinder fitting into the top of the Blue Bottle. Tighten with wrench.

Connect the yellow charging hose from the vacuum pump port to the brass cylinder fitting. Connect the red charging hose from the port on the recovery H-stand to the middle terminal of the manifold gauge.

Connect the blue charging hose from the left terminal of the manifold gauge to the Insta-tap Vicegrips. Make sure the valves on the manifold gauge are closed.

Tap into the cooling system using the Insta-tap Vicegrips. The primary puncture point should be into the low side of the system, above the compressor to avoid oil leakage. This is usually the larger line leaving the compressor. A correct puncture will be confirmed with a positive pressure reading on the left manifold gauge. If no pressure is registered, the system is empty or the puncture was ineffective. If this occurs, release Vicegrips and retry.

If there is positive pressure, open left valve on the manifold and turn vacuum pump ON. Regularly close the left valve while evacuating to see progress and re-open. Once the left manifold gauge reads negative pressure while the valve is closed, the system is empty. Continue to evacuate for one minute with the valve open before turning vacuum pump OFF.

Close all valves and release Vicegrips from white good. If CFC refrigerant continues to leak out, re-attach Vicegrips and repeat evacuation procedure

PROCEDURE (cont'd): A Blue Bottle is full if the net weight is 1, 5 or 10 lbs. for small, medium or large bottles.

To change bottles, unscrew the hoses and the recovery H-stand. Remove the brass cylinder fitting from the top of the Blue Bottle. Place protective caps on top and bottom of Bottle and mark FULL on side of bottle or on attached tag, indicating the type of refrigerant.

Different refrigerant types cannot be mixed in the same Blue Bottle. A separate Bottle must be used for each refrigerant type (e.g. CFC-12, CFC-22, CFC-134A). When switching Blue Bottles to recover a different refrigerant type, the recovery system does NOT require purging.

Unplug vacuum pump from generator or outlet. Turn portable generator OFF.

To store recovery equipment, unscrew all hoses and replace all protective caps on terminals. Be sure to store vacuum pump at room temperature.

CFC Removal Demonstration Project
OPERATIONAL PROCEDURE

MODE OF SERVICE: **Recovery of CFC Refrigerant Using Thermaflo Recovery Unit**

PURPOSE: To safely remove all CFC refrigerant from household white goods prior to disposal and/or metal recycling.

EQUIPMENT: Thermaflo OZ4000 Recovery Unit, recovery tank (50 lbs.), four charging hoses (2 yellow, 1 red, 1 blue), manifold gauge set, Insta-tap Vicegrips, In-line filter drier, coveralls, gloves, work boots, safety glasses, portable generator, extension cord, wrench.

SAFETY PROCEDURE: Wear protective equipment at all times. If a white good is leaking and emitting a strong, foul odour, do not attempt to recover refrigerant. If a white good contains sulphur dioxide (SO2) or ammonia (NH3) as a refrigerant or any other non-CFC refrigerants, do not attempt to evacuate.

PROCEDURE: Plug recovery unit into portable generator or electrical outlet. Turn ON generator.

Remove all protective caps from terminals. Make sure all valves are closed.

Connect the in-line filter drier to the inlet terminal on the back of the recovery unit with the wrench. The flow arrow should point toward the recovery unit.

Connect the first yellow charging hose from the center terminal of the manifold gauge to the inlet terminal on the recovery unit.

Connect the second yellow charging hose from the left terminal of the manifold gauge to the Insta-tap Vicegrips.

Connect the red charging hose from the discharge terminal on the recovery unit to the liquid valve on the recovery tank (red valve).

Connect the blue charging hose from the tank return terminal on the recovery unit to the vapour valve on the recovery tank (blue valve).

Tap into the cooling system using the Insta-tap Vicegrips. The primary puncture point should be on the low side of the system, above the compressor to avoid oil leakage. This is usually the larger line leaving the compressor. A correct puncture will be confirmed with a positive pressure reading on the left manifold gauge. If no pressure is registered, the system is empty or the puncture was ineffective. If this occurs, release Vicegrips and retry

If there is positive pressure, open the left valve on the manifold. Bleed the air in the hose leading to the inlet valve until CFC escapes. Open inlet valve and discharge valve on the recovery unit. Bleed the air in the hose leading to the liquid side of the recovery tank. If CFC escapes, open the liquid valve on the tank

PROCEDURE (cont'd): If no CFCs escape, set recovery unit on RECOVER, RECOVER and turn unit ON. Wait 10 seconds and open the liquid valve on the recovery tank and continue to evacuate.

Open vapour valve on the recovery tank and bleed air from hose leading to the tank return valve on the recovery unit. If CFCs escape, open tank return valve and continue to evacuate. If none escape, close vapour valve on the recovery tank and continue. Repeat this step every minute.

Regularly close the left manifold valve while evacuating to see progress and re-open. Once the left manifold gauge reads negative pressure while the valve is closed, the system is empty. Continue to evacuate for one minute with the left manifold valve open.

Close the left manifold valve. Close the inlet valve on the recovery unit. Close the discharge valve on the recovery unit. Close the liquid valve (red) on the recovery tank. Close the vapour valve (blue) on the recovery tank. Close the tank return valve on the recovery unit. Turn the recovery unit OFF.

Release Vicegrips from white good. If CFC refrigerant continues to leak out, re-attach Vicegrips and repeat evacuation procedure.

When evacuation of white goods is complete for that service day, the recovery unit must be evacuated. Please refer to SELF-EVACUATION procedures for the Thermaflo OZ4000 Recovery Unit.

To store recovery equipment, unscrew all hoses and replace protective caps on terminals. Be sure to store recovery unit at room temperature. Recovery tanks should be cooled to reduce tank pressure.

CFC Removal Demonstration Project
OPERATIONAL PROCEDURE

MODE OF SERVICE: **Self-Evacuation of Thermaflo Recovery Unit**

PURPOSE: To safely remove all CFC refrigerant and residues from the CFC recovery unit prior to storage.

EQUIPMENT: Thermaflo OZ4000 Recovery Unit, recovery tank (50 lbs.), two charging hoses (1 red and 1 blue), coveralls, gloves, work boots, safety glasses, portable generator, extension cord.

SAFETY PROCEDURE: Wear protective equipment at all times.

PROCEDURE: When evacuation of white goods is complete for that service day, any CFC refrigerant or residues must be evacuated from the unit prior to storage.

The recovery unit should be plugged into the portable generator or electrical outlet and all valves should be closed.

The red charging hose should be connected from the discharge terminal on the recovery unit to the liquid valve on the recovery tank (red).

The blue charging hose should be connected from the tank return terminal on the recovery unit to the vapour valve on the recovery tank (blue).

Set the recovery unit on SUB-COOL, RECOVER.

Open the tank return valve on the recovery unit. Open the discharge valve on the recovery unit. Bleed the air from the liquid hose (red) leading to the recovery tank. Open the liquid valve (red) on the recovery tank.

Turn recovery unit ON.

Allow the recovery unit to run until the pressure reading on the left gauge (suction pressure) reads less than 10 inches.

Close liquid valve (red) on the recovery tank. Close the discharge valve on the recovery unit. Close the tank return valve on the recovery unit. Turn recovery unit OFF.

Disconnect the blue charging hose from the tank return terminal and connect to the self-evacuate terminal on the recovery unit. Turn the self-evacuate selector knob on the back of the recovery unit to ON

Open the self-evacuate valve on the recovery unit. Bleed air from the vapour hose (blue) leading to the recovery tank. Open the vapour valve (blue) on the recovery tank. Open the discharge valve on the recovery unit

Set the recovery unit on SELF-EVACUATE, RECOVER. Turn the recovery unit ON

PROCEDURE (cont'd): Allow the recovery unit to run until the pressure reading on the left gauge (suction pressure) reads less than 10 inches.

Close vapour valve (blue) on the recovery tank. Close the self-evacuate valve on the recovery unit. Close the discharge valve on the recovery unit.

Turn the recovery unit OFF. Turn the self-evacuate selector knob on the recovery unit to OFF.

When switching from one type of refrigerant to another, two separate recovery tanks must be used. Prior to switching tanks, the SELF-EVACUATION operation must be completed. Remove hoses from tank and run the recovery unit on air in both the RECOVER and SUB-COOL modes for 30 seconds each, to purge any residue from the unit. The SELF-EVACUATION operation must then be completed one final time without a recovery tank to purge any air from the unit. Attach hoses to new recovery tank.